SCIENCE

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*PHYSICAL ANTHROPOLOGY.**

PHYSICAL anthropology is that branch of the broader field of anthropology which treats of physical man. It has nothing to do with man as a social being; it is not concerned with the products of his hands or of his brain; it deals neither with technology, language, government, law, sociology, folk-lore nor religion; it treats of man as an animal.

We may for the sake of convenience consider four views of the subject. These are: (a) the scope of physical anthropology; (b) the problems of physical anthropology; (c) physical anthropology in its relation to museum exhibition; and (d) the importance or value of physical anthropology.

(a) *The Scope of Physical Anthropology.*

Physical anthropology assumes that man is an animal; is a member of the brute world, and it follows that man is to be studied as other animals are studied. It is then a part of zoology, which has for its study the entire animal world; and in this world man demands the most attention and the closet scrutiny, for he is both the most important and the most widely distributed of all animals. Applying the methods of zoological investigation to man, physical anthropology asks of his ancestry, of the time of his appearance on earth, of his kinds or varieties or species, of the comparative fertility of races, of the fertility of hybrids, of the laws of heredity and descent, and of the nature and influence of food, climate and environment upon man, and finally of man's relation to other animals.

* A lecture delivered at the Field Columbian Museum, March 20, 1897.

It becomes evident at once that in the various investigations which are instituted in the study of physical man we must have the assistance of other studies which are closely related. Thus by the aid of paleontology we may hope for light on the problem of man's first appearance, both in time and place, and also on the problem of man's ancestors, for paleontology is simply the study of zoology in geological times; it is the archaeology of zoology. Again, by the aid of embryology, we may hope to learn something of man's origin, for it is one of the laws of biology that the developmental history of the individual is an epitome of the developmental history of the race. With the aid of anatomy, the study of gross structure, we are able to compare the varieties of men and so classification and division become possible, and by means of comparative anatomy we can compare man's structure with that of other animals and thus learn of relationships. With the aid of physiology and experimental psychology we are enabled to judge of the comparative physical functions and mental activities of the different races. It must be added that no one or even all of these studies combined is physical anthropology. The data which they severally and collectively furnish make possible the broader, more comprehensive study of physical man.

It is well also that we remind ourselves that the study of physical anthropology has only recently become a possibility. The time was not so very long ago when man rebelled at the thought that he had anything in common with the animals; he forgot or overlooked the fact that his entry into and exit from this world were like other animals, that his life was and is a struggle for existence, that his physical nature was so like that of animals that the same laws of evolution which produced the one must have produced the other, must have produced all, must govern all. And so the skeptics of the scientific and unscientific world cried: Produce your missing link! The 'missing link' is dead, and almost forgotten, but in his stead has arisen, from the study of paleontology, embryology and comparative anatomy, an array of facts which unite man to the animal world in a manner so close and intimate as to admit of no questioning. As one anatomist* says: "Blood relationship and not some unknown plan of creation forms the invisible bond which unites organisms in various degrees of similarity, and in this great family man must find his place. He forms but a link in the chain, and has no right to consider himself an exception."

It may seem strange that after physical anthropology has been declared to be that part of zoology which deals with man that there should be any need to speak of the *methods* which are essential to its proper study. But the field offers such large opportunities for superficial work, and so much of that sort has been done that we may well devote a few minutes to the consideration of this subject. We hear so much of 'reversions,' 'simian traits' and 'anthropoid characters' that we are bewildered, and after all the evidence is in we can only conclude that man's ancestors were wonderfully and fearfully made. There is, indeed, in the different races of men, or in any one of them, an enormous amount of variation. A naturalist† asks: "Are not Esquimaux and Bushmen, Samoyedes and Australians, American Indians and Fantis much further apart than any two species of monkeys, of larks or butterflies?" While an anatomist,‡ speaking of the shoulder-blade, says: "I do not know what range of

* Wiedersheim: Structure of Man, p. 2.

† Sir Henry Haworth: *Natural Science*, Sept., 1896, p. 185.

‡ Professor T. Dwight: The Range and Significance of Variation in the Human Skeleton. Boston, 1894, p. 23.

variation a great series of the scapulæ of the larger felidæ might present, but a small one shows nothing like that of the human race, and I might even add that of the Caucasian."

But because certain parts of man's skeleton bear close resemblance to the gorilla, other parts to the chimpanzee, still others to the orang and gibbon, does it follow that man, in his race history, has been successively a gibbon, an orang, a chimpanzee and a gorilla? Surely it would seem no one would claim for man such a pedigree as this, but this has been done, if not openly, it at least has been tacitly implied. And hence the need of definite scientific methods which make such reasoning impossible. Naturally, all the methods of zoological investigation are not applicable in the study of the human species, but at least two are of the utmost value; they are the statistical, or mathematical, and the morphological. The use of the statistical method in anthropology, and its extension in zoology, is due very largely to Mr. Francis Galton. Its basis is an application of the laws of chance, and Galton has devised special apparatus to illustrate its application. The method is of great value in comparative studies, such, for example, as the various indices, which are determined from measurements on the skull. Thus, if we take the length of the skull in a thousand individuals, and arrange the results according to their distribution, we shall have a curve, the character of which will be determined by the uniformity of the individuals measured. If they are all of one race, and that race is free from admixture with other races, we shall expect to find a curve which is high in the center and of a uniform character. If, on the other hand, the race is a mixed one the curve will be broad in proportion to its height and will be irregular in its course. In other words, the character of the curve is largely determined by the number of disturbing causes. Just as in Galton's apparatus, the character of the curve described by shot which falls upon a compartment, striking in its passage pins, will be determined by the height from which it falls and the number of pins it encounters in its passage. By means of these curves, that is, by the use of the statistical method, the greater part of anthropometric investigations are shown.

In the second method, the morphological, we deal with form and arrangement, and the unit is not the individual, but the species. The method proceeds by homology and it recognizes in variation an indication of the slow modification of the race or species. In other words, morphology is simply an extension of comparative anatomy. It calls to its aid embryology and histology, or the study of minute structure. A character which appears occasionally in man and is always present in the apes is not to be called 'simian' until its pedigree has been carefully determined and it can be shown to have been a transmitted character or an actual reversion. A close adherence to the methods of morphology may not unravel all the problems which are presented in man's strucure, but it will make impossible many of the so-called deductions which thus far have been put forth in the name of physical anthropology.

(b) *Problems of Physical Anthropology.*

We have to consider in this place not so much what has been done as what remains to be done, for, although much has been accomplished, the field of investigation still remains very broad. In the first place, we do not yet know the exact lines of man's descent. His cousins are pretty well known, but his immediate ancestors are not yet discovered. There is yet to be learned even the approximate time of man's appearance *as man* upon earth. That time has been stated within the last year by one writer to

have been 15,000 years ago, by another to have been 200,000 years ago. The extreme antiquity of man's appearance is no longer questioned, for in Europe his remains have been found associated with the bones of long extinct mammals. Further evidence of his great antiquity has been found in Africa, Asia and America, and only recently remains have been found in Java which have up to this time defied the best anatomists of Europe to determine whether they belong to man or to some extinct ape. At any rate, they may be characterized as the most human-like of the apes so far known, or the most ape-like of any man yet discovered. But the real importance of the find in Java lies in the fact that we may hope for further discoveries which may throw light on man's origin. There are still vast areas of Quaternary and Tertiary deposits in Asia, Africa and the islands of the Indian Ocean which await investigation, and it is not too much to hope that the next twenty-five years will see greater advances in our knowledge of man's past history than we have seen in the last century.

There is another problem awaiting solution and it is, to a certain extent, bound up with the one just considered; it is the old question, put in a new form, of the single or multiple origin of man—monogenism or polygenism. The facts as at present known are these: With the exception of the Java find and possibly one or two skulls found in Europe, man seems to be not only *man*, but go back as far into the past as we can, we find the several types of mankind already existing as we know them to-day. On the most ancient of the Egyptian monuments we see depicted in a distinct manner the Egyptian Fellah, the Hadandowah and the Negro. If we consider the skulls which have been found in Europe and America along with bones of extinct mammals we have the long heads and the short heads—the types which appear to-day, and which furnish much of the basis of anthropological classification. Where or when did the lines begin to diverge? Was it due to a plurality in man's ancestry or was it due to environment? And why have the types of ancient times persisted down to the present day? We do not know yet why the skin of the negro is black, any more than we know why it remains black; nor do we know why his hair in cross section is long and narrow in shape, while that of the Indian is circular.

These questions and riddles are simply part and parcel of the great problem of heredity, and if the study of anthropology does no more than solve that, it will amply have earned its title to recognition. A distinguished English anthropologist declares that even to-day there may occasionally be noted the reappearance of physical types which existed in Europe contemporaneously with the cave-bear and the mammoth; while one of America's foremost anatomists has declared that in the occasional appearance of a third trochanter we have a survival of a structure which is an essential feature of the horse and the rhinoceres. When we know preciesly what heredity means, what can be inherited and what can not, then we may hope to know more of man's origin and of his destiny.

But the subjects of investigation are not only to enquire into the past; they include the men, the races of to-day. Surely the field is broad enough here, and no one who has explored even a corner of it doubts its importance and interest. But how much do we know of it? The physical history of the races of Europe has only been written within the last five years and it is far from complete. What do we know of the peoples of Africa or of the aborigines of America? Not nearly as much as we know of the mammals or of the butterflies of these countries. Yet in these peoples we have, if we would but look, a picture

full of suggestion as to man's primitive condition. It is as if the geologist could visit some remote spot and behold the earth as it existed in Tertiary times. Would he neglect the opportunity? In many of the peoples of Africa and Oceania we find types of bodily structure which are not described in the anatomical text-books of Gray or Quain. There we may see important differences from the European type in cranial capacity, in the size and structure of the brain, in the relative lengths of the arm and leg, in the pelvis, in the musculature of the hand and foot, in fact in the entire bodily structure; and these differences are significant. In the heart of Africa are dwarfs that in bodily structure and mental calibre are very far removed, indeed, from the European. In other parts of the world dwarf races have lately been discovered. Are they the survivals of primitive times, or are they the degenerate offspring of a once vigorous ancestry? These are a few of the subjects still awaiting investigation.

The field is surely broad, but how little cultivated! The proper study of mankind may be man, but curiously enough man does not seem to have cared to study mankind. As one of America's foremost students of anthropology has pointed out, man 'has never seriously and to the best of his abilities made a study of his own nature, its wants and its weakness, and how best he could amend the one and satisfy the other.' The reason for this is hard to discover, but for the present we are most concerned in the consequences; and to illustrate the extent to which a lack of the desire to study man will lead, we may take a single example. Among the general instructions to the officers of the Challenger Expedition we find the following:* "Every opportunity should be taken of obtaining photographs of native races to one scale; and of making such observations as are practicable with regard to their physical characteristics, language, habits, implements and antiquities. It would be advisable that specimens of hair of unmixed races should in all cases be obtained." And what was the result? From an expedition which in its importance ranks only after that of Columbus and Magellan; which consumed years of time and cost the British government in round figures $600,000—from this expedition the total contribution to the knowledge of the races of men were some notes by two of the officers, a few unsatisfactory photographs, a few bones of skeletons and *sixty-four* skulls! There is a serious side to such a neglect of opportunity as this.

In 1803 Tasmania's population was 7,000; to-day there is not a single representative left. In 1842 the Maoris of New Zealand numbered 140,000; to-day there are less than 30,000. When Macaulay's New Zealander gazes on the ruins of London there will be no New Zealander; the name 'Maori' even will be as unfamiliar then as is now the name of some obscure Germanic tribe of the times of Tacitus. What is true of New Zealand is rapidly becoming true of all the islands of the Pacific; it is true of nearly all the North American continent and for large areas of the Southern.

The field for the study of physical man is broad, but the scene is ever changing, and it behooves us to-day, if we would not merit the just condemnation of the ages to come, to observe, to record, to make use of the camera, the phonograph, the calipers and the color-scale. But how often on any of the great scientific expeditions is there any one fitted by previous training to observe correctly and accurately the races of men that may be encountered? Recall, if you please, the numerous expeditions which have penetrated Africa, crossed Asia and

*I am indebted for this information to *Natural Science*, Vol. VII., No. 41, Special 'Challenge' Number, pp. 7 and 74.

traversed the islands of the Pacific, and we find men competent to observe and collect reptiles and birds and fishes and mammals, to study botany and geology, but how often is anthropology represented? Surely no one doubts that previous training is just as essential in the one case as in the others. But there is already an attempt in some countries to remedy this. In London, Paris and Berlin one can receive instruction from competent teachers as to the best methods of recording and observing, as well as a knowledge of what is best to observe and record. As a result of this, a wide-spread interest is being manifested in anthropological matters by army and naval officers, as well as by the civilians of the European countries, and there is growing up in each of the great Continental cities storehouses of information about the peoples of the different parts of the world. Not only that, but the universities are awakening to the importance of the study of man. As a sign of the times, we may read in one of the February numbers of *Nature:* "Dr. A. C. Haddon is this term giving two well-attended classes (one elementary and one advanced) in physical anthropology at the Anatomy School." And what is true of Cambridge is true to a greater or less extent of fifteen other European universities.

In America, while general instruction in anthropology has for number of years been given in several universities, a special course in physical anthropology is offered by Dr. Boas in Columbia for the first time this year, and in the University of Chicago courses covering the entire field of physical anthropology have been given by Professor Starr since its foundation.

(c.) *Physical Anthropology in Relation to Museum Exhibition.*

Up to the present time there is no museum or section of museum which adequately or worthily represents the subject of physical anthropology. There are museums of zoology, of botany, of geology and of anatomy, but no museum which shows the races of men as they should or might be shown. Obviously, it will be beyond the limit of our time to treat, with any degree of fullness, of the possibilities of a museum of physical anthropology, but we can at least attempt to lay down the general lines on which a museum should be built, and which ought to be possible of accomplishment.

The ideal museum of physical anthropology then will have at least three sections or divisions. In the first should be shown the instruments and apparatus which are used for making and recording the various observations which are taken both on the living subject and on the cadaver or skeleton. By the use of charts and diagrams the methods of tabulating and recording these observations may be shown. There ought, furthermore, to be in this section a room or rooms in which an individual who applies can be measured or tested according to the accepted standards of anthropometry and psychometry. Such facilities would serve a twofold purpose. To the subject they tend to awaken an interest in himself and may be useful in indicating physical and psychical defects or weaknesses which may be easily remedied. From personal interest in the subject to a broader and more thorough understanding of the aims and methods of anthropology, is a matter of easier accomplishment after the individual has had even this slight introduction to the science. On the other hand, these observations on the living subject, when made in sufficient quantities, enable the observer to draw valuable deductions in regard to vital phenomena, such as the laws of growth, sexual differences, the influence of nationality, of climate, of nourishment and of occupation, together with the effect of all these on stature, on lung capacity, on strength, on mental activities, etc. Much

has been done along these lines that is valuable, but many important problems have yet to be investigated, the solution of which will help not a little to a more correct understanding of the possibilities and limitations of human life.

In the second section of this ideal museum the aim will be to interpret and explain physical man. Naturally, the subject is treated in the broadest and most general way, the object being primarily to exhibit man as a zoological unit; but there must be many sub-sections or divisions. In one group we may properly begin with the embryological history of man. Such an exhibit is not only possible, but, owing to the improved methods of museum display, can be made very attractive as well as instructive. Not only can man's interuterine life be shown by means of alcoholic specimens, but this may be thoroughly well illustrated, and even the early stages rendered visible, with the aid of the wax and plaster models, which are now made with the greatest exactness and scientific accuracy. With such assistance, many of the most interesting facts of man's history can be made clear. For example, as the various stages of embryonic life are unfolded, we see as it were an epitome of man's past history, for it is one of the laws of biology that the developmental history of the individual is a resumé of the developmental history of the race. By the illustration of this law, as man is seen to pass successfully from the stage of a single cell, through that of a jellyfish, when later he has the gill pouches of a fish, and the freely projecting tail of mammals, the fact is burned in that man is but a 'link in the chain.'

Another subsection will be devoted to the skeleton. No matter where the skeleton is to be placed or what part it is to play in the exhibit of other branches of zoology, in physical anthropology its place is *not* in the closet, but in full sight; and one museum at least in America has ably demonstrated that the skeleton can be made as beautiful, as attractive and as interesting as any subject of a natural history exhibit.* Furthermore, the skeleton may or may not be morphologically valuable;† it forms an extremely important part in any exhibit of man. Of all the bodily systems it is easiest preserved and the most enduring; it alone of the body furnishes us with our knowledge of extinct and fossil man.

The first object in the exhibit of the skeleton is to make easily familiar the names, positions and relative importance of the various members, individual bones and parts of bones; in other words, there should first be an illustrated text-book of normal human osteology. The visitor is then prepared for something better and we may next show the development of the skeleton. First to be shown would be the fœtal skeleton in ligamentous preparations, and then a series of articulated skeletons, ranging in age from birth to full maturity, terminating with the skeleton of old age. The attempt may next be made to show the range of variation of the skeleton, not for the European race, but for man, drawing for our material upon all races. This series can be made of the greatest interest, and when properly formed and labeled is of the utmost importance. We should have in this group two series, one showing the descriptive variations or those which can easily be detected by the eye and readily and fully described in the labels; the second series illustrates those variations which are best described by terms of mathematical precision. As an example of the first series we may mention, to take the skull alone, the variations in the sutures or lines of articulation of the bones, their degree of serration, the time in life of closure, the

* The Wistar Institute of Anatomy and Physiology in Philadelphia.

† Cf. Minot's Human Embryology, p. 422.

influence of the shape of the head by premature closure, anomalous sutures such as the persistent frontal or subsagittal or interparietal, and, finally, the supernumerary bones which appear occasionally in certain sutures. As examples of the second series we may illustrate such craniometrical observations as the variations in the cubic capacity of the skull, or the cephalic index—the relation of the length to the breadth of the skull; or, of other parts of the skeleton, the various forms of pelvic and scapular indices. Still another but minor group should illustrate the diverse forms of artificially deformed skulls which are found in various parts of the world, and along with them should be shown the cradle-boards, bandages and other appliances which were used to produce such deformation.

If we include the teeth in our exhibit of the skeleton there is much that can be shown. Thus we would have illustrated the time of eruption of the milk and permanent teeth, the degrees and causes of wear, the appearance of the jaws due to loss of teeth, and the changes which have taken and are taking place in man's dentition. Still another series or subsection presents in one comprehensive view the skeleton of man by the side of those of his first and second cousins, from the gorilla down to the lowest lemurs, including the models or casts of the earliest human bones which have yet been found. In fact, the limits are very wide to this section which is devoted to the skeleton. Many of the changes which have taken place in man's gradual acquisition of the upright position can be shown and made most instructive; such modifications can still be seen in the pelvis, the bones of the arms and legs, the shoulder-blade, and in the gradual shifting of the great body cavities, as seen in the variation in the number of ribs and vertebræ and the gradual shortening of the breastbone. This, by no means, exhausts the interesting and instructive changes which can be rung on the skeleton and its component members. But all of this requires an unlimited supply of material from widely distinct races; it also requires, for purposes of illustration, free access to the skeletons of apes and other mammals, and even of lower vertebrates.

But of the first general section we have considered only one system of man's structure; the others should have their proper amount of attention. Here we meet with a real difficulty; the other systems are only prepared and exhibited at considerable labor and expense, and, worst of all, we can not have such free command of material from all races from which to draw. We can dig up the bony remains of the Papuan, but he refuses to be dissected. There is, however, much that can be shown. Take the muscular system; by means of alcoholic and dried preparations, and by following a definite scheme, we can hope to show some of the variations which demand 900 pages for their description at the hands of a French anatomist.* By a careful arrangement we can demonstrate that certain muscles are peculiar to man, those which are required by his upright position and especially by the extended use to which he puts his hands; that he retains other muscles which he no longer needs, as, for example, some of the muscles of his ears and feet; and, finally, that there are occasionally present muscles which, in general, man has lost, but which still survive in an extremely rudimentary condition in some men, such as the caudal or tail muscles.

With the *nervous system* the problem of exhibition becomes at once less difficult again, and the possibilities of museum display are very great. Those who were fortunate enough to have visited the Section

* Testut: Les anomalies musculaires chez l'homme. Paris, 1887.

of Neurology* in the Anthropological Building at the World's Fair need not be told of the pleasure which may be derived from a thoroughly well arranged exhibit of the nervous system. In the ideal museum it will be possible to read the story of the development of a man's brain, from its lowly beginning as an infolding of the outer germ layer to that complete organ of the adult which in its structural form so closely resembles the brain of the higher apes, but which in its potentialities and possibilities is as far removed as man himself is from the brute creation. But there is more than mere development to be shown. Even the brain of the adult is subject to great variation from the normal, and all these variations are interesting from the standpoint of morphology. Then there is the correlation of the brain to the skull which must be shown, along with the casts of the cavity of the skull. The subject is by no means exhausted yet, but enough has been said to point out, although imperfectly, the possibilities which this system lends to museum purposes.

Of the other four great systems of physical man I shall stop for only one, and in that shall select a single example. I refer to the variations in the arch of the aorta, the great blood vessel which leads from the heart. In all the systems or parts of systems of man's structure there is none, perhaps, which betrays his humble origin so well or so convincingly as the variations which we find here. It is not that in the embryological development of the circulatory system in general we can trace man's pedigree from a condition more primitive than that of the fishes, but that, to return to our example, in the adult variations of the aorta we may find a single aortic arch on the left side, the normal condition; or a single arch on the right side, the condition of birds; or a right and left, or double arch, the condition in reptiles.

*Under the able direction of Professor H. H. Donaldson, of the University of Chicago.

In all of these four great systems, to say nothing of man's outer covering, such as the skin and hair, there are similar interesting facts, which, by means of corrosive and injection preparations or preservative fluids, may be exhibited in an attractive manner and serve as illustrations for the text-book of humankind.

In the third section we do not consider man, but men; not the species man, but the varieties of men; and hence we may characterize this section as special or ethnic. The aim is to present, as compactly and attractively as possible, a bird's-eye view of all the groups of people from all parts of the world. Such an exhibit, properly made, carefully installed, and fully and accurately labelled, ought easily to excel in interest any exhibit that can be made of any department of science. An exhibit, for example, of a group of casts of Australians, true to life in color, expression, form and dress, is just as much more interesting than a group of stuffed kangaroos as a group of live Australians is of more interest than a group of live kangaroos; and for proof of the correctness of the latter observation one need only take a single glance at the distribution of a crowd at a circus.

As to details, of course, there will be much divergence of opinion, but we cannot go very far astray if we follow, as a general rule, a geographical order. There will be times, to be sure, when it will not be practicable or wise to do this, but if we begin with the dark-skinned races, such as the Negrittoes, Papuans, Australians, and Negroes of Africa, we can readily pass over to the brown or insular peoples of the Pacific, such as the Malays, Indonesians, etc. We can next take up the continent of America, and then, passing over into Asia by the northwest coast, can cross Asia and so finally traverse Europe. In this manner

we shall not only have circumnavigated the globe, but have done it in an orderly manner, and at the same time have kept near to the line of the physical development of the races.

Naturally, when we come to select the groups and tribes to be represented there will be more difference of opinion, but the main point is to select such groups as are *types*, those which show decided variation from their neighbors, either in color, in stature, in hair, or in physiognomy. The limit to be put on the number of the groups will, of course, be determined very largely by the means at our command for this purpose, but certainly an exhibit which includes less than sixty groups would be incomplete and more or less unworthy of the subject.

There is next to be determined the exact character or nature of the material which is to be included in each group. This again must, to a large extent, be a matter of expediency or possibility. For some groups an abundance of material will be available; for others we must be content with a scant amount. But still it will be possible to keep in mind a standard below which it will be unwise to fall. There should be on the one side the group of casts, colored and dressed with the utmost accuracy and scientific precision. From these figures can be studied the color, shape, size, hair, facial expression, relative length of limbs, shape of hands, feet, etc., as accurately as from the living subject. This should include at least three figures—the man, woman and child. By their side we may show the mounted skeletons, the scaffolding of the body. On the opposite side are series of skulls, shoulder-blades, pelves, long bones, etc., selected in such a manner as to present the typical osteological characters of the group we are representing. At the center and in the back are type photographs, anthropometric charts, diagrams of sections of hair, etc., and a map showing the exact geographical distribution of the group. Other maps or charts showing the physiography, fauna, flora and climate should be added whenever possible. Every object exhibited is to have its own individual label, and there is, of course, to be in the center a comprehensive label which sets forth in brief, concise language the chief characteristics of that particular group.

In other words, as the first section illustrates the aims, objects and methods of physical anthropology, as the second section defines and exhibits the species man and sets forth his position in the animal world, so this, the third section, is an illustrated text-book of races and peoples, of ethnography.

But we are not yet concluded with our scheme for an ideal museum, for so far provision has only been made for the casual visitor and the thoughtful student; provision must also be made for the investigator. A museum which fails to have its study series can never be considered complete. The museum can not, it does not, aim to supplant the universities, but it should aim to supplement them. It should clearly be borne in mind that the museum of to-day, if it is to be worthy the name, must be built up from the results of field exploration and investigation. No systematic or comprehensive scheme for a scientific museum can be carried out from random gifts and occasional purchases. Accessions from such sources as these may in time grow into vast *curio halls*, but never into the scientific museum worthy the building which houses it, or the time of its care-takers.

It is rare, indeed, that it is possible or desirable to place on permanent exhibition all the material which may be gathered from any single expedition. The duplicates, thus acquired, are too often regarded as encumbrances, fit only for purposes of exchange, or, if that be impossible, they are

piled away in the attic, or even, worse still, in the bottom compartments of the exhibition cases, there to grow mouldy or to be eaten up by the moths. But in the real museum such duplicate specimens, and those not suitable for exhibition purposes, are carefully assorted and those which may be of interest to the student or investigator are arranged in suitable compartments in well lighted rooms, where they may be readily available for study. Such series represent the 'stack' of a great Library; they make possible rearrangement and extension of the exhibition series, and, best of all, they give to the museum, in direct proportion to their fullness, completeness and permanency, and serve the purpose of awakening not a local, but a national interest. Such series would contribute largely to obviate the necessity of American students going abroad for material for study.

(d) *The Importance or Value of Physical Anthropology.*

And now, last of all, we have to consider this question: Is the study of anthropology worth the time, and is its proper exhibition worth the cost and labor? In other words, what is the ultimate aim of physical anthropology, what can it teach, what is its value?

The aim of physical anthropology is to *know* physical man, to unravel the mysteries of his nature. It follows the individual throughout the entire course of his life. It enquires into his origin and his evolution down to the present day. It enquires into the varieties of man and asks for the causes which have made these varieties; why are some men black, why are others white, and, more difficult to answer, it asks why the black remain black and the white remain white. Its aim is to enquire into the condition of physical progress, to study the effects on man of soil and climate; in short, of environment. It enquires into the laws of heredity and descent, into the laws of health and disease, and it asks for the factors which make for longevity and robustness, a sound mind in a sound body.

Physical anthropology teaches us that all men are not born equal; that every child at birth is "endowed with the heritage transmitted from innumerable ancestors, and is already rich in personal experiences from its prenatal life; that these combined decide the individual's race and strain, and potentially incline, if they do not absolutely coerce, his tastes and ambitions, his fears and hopes, his failure or success."* It teaches us that man has acquired, and only recently, his upright position, and that he is not yet perfectly adapted to it; that the evolution of sex has gone on further in man than in other mammals; that the entire structure is slowly and progressively modified from birth to adult age; that then retrogressive changes set in which, in some respects, are infantile in character. It teaches not only that there has been a gradual evolution of man's physical nature, but that influences are still at work which will produce yet further changes and modifications; that the man of the future will not be like the man of to-day.

The aim of physical anthropology is to know physical man, and herein lies its value; for when we know man then can we answer some of the problems which confront man, and on the proper solution of these problems rests the destiny of nations and the ultimate destiny of man himself. These problems are many, and demand immediate answer. Morphology, the study of variation, is the hand-maid of pathology, and a knowledge of the causes of disease will aid materially in its prevention. With a larger and more enlightened view of the effects of environment, we can hope to see

* Brinton: The Aims of Anthropology, SCIENCE, Vol. 11., 1895, p. 241; Proc. A. A. A. S., Vol. 44, p. 2.

solved the problem of acclimatization, a problem which so far has baffled physicians, and which has even been declared insoluble; but which, if ever solved, will change the complexion of the earth's surface and inaugurate a new era in the history of mankind. A broader knowledge of physical man will throw light on that most intricate and obscure problem of miscegenation or race-intermarriage, a problem which, it has been declared, is exceeded by no other in its effects on the 'future prosperity or failure of the human species.'

The study of physical anthropology teaches us that not only are all men not born equal, but that tribes and races and nations are inevitably doomed to give way and perish before the advance of their more fortunate fellow-men; that the time is not far distant when a certain few races will have peopled the globe, when no survivor of the native population will exist on a territory which covers an area of twenty-five million square miles and which, four hundred years ago, contained one hundred million inhabitants.

To know physical man, his past history, his present possibilities, his future destiny —such is the aim and value of physical anthropology, but not least in value is to teach him his place in nature.

GEORGE A. DORSEY.

FIELD COLUMBIAN MUSEUM.

THE ASSOCIATION OF AMERICAN ANATOMISTS.

THE ninth annual session of the Association was held in the Columbian University Scientific School, Washington, D. C., Tuesday to Thursday, May 4 to 6, 1897, in conjunction with the other societies comprising the Congress of American Physicians and Surgeons.

Dr. Frank Baker, President of the Association, presided at the several meetings. The following members were present at some time during the session: Baker, Bevan, Blake, Bosher, Browning, Carr, Dawbarn, Gerrish, Gill, Hamann, Hewson, Hodge, Hunt, Huntington, Hutchinson, Kemp, Lamb, Leidy, Mears, Miller, Mixter, Moran, Parkhill, Reisinger, Roberts, Shepherd, West and Wilder—28 in all.

The Association was called to order by the President who delivered an address, which will be printed in SCIENCE.

Dr. D. S. Lamb, Secretary and Treasurer, submitted his report for the period which had elapsed since the last session, December 27 and 28, 1895, which was accepted. The following are extracts: "No meeting was held in December, 1896, in view of the fact that this Association is a member of the Congress of American Physicians and Surgeons, which meets in this city in May every third year. The Executive Committee believes that if we should meet both in December and the following May the short interval between the meetings would imperil the success of the May meeting, at the same time regretting that by postponing the December meeting we lose the opportunity of attend- the sessions of the Society of American Naturalists and the affiliated societies. This is the second time this postponement has occurred and in the nature of things seems inevitable every third year.

"Since the last meeting three members have died. Sir George Murray Humphry, an honorary member, professor of surgery and late professor of anatomy in the University of Cambridge, England, died September 24, 1896. He is perhaps best known as the author of a classic work on 'The Skeleton.' Dr. Charles Heitzmann, of New York City, at one time lecturer on morbid anatomy in the University of Vienna, and who afterwards conducted a Histologic and Pathologic Laboratory in New York City, author of a work on anatomy, having occasion to go to Europe for his health, resigned September

16, 1896. Sometime afterwards I saw a notice of his death while abroad; the exact date I cannot give. Professor Edward Drinker Cope, professor of vertebrate paleontology in the University of Pennsylvania, and author of many works on American Paleontology, died in Philadelphia, April 12, 1897."

The Executive Committee reported favorably on the following applications for membership: Drs. V. P. Blair, J. A. Blake, Thomas Flavin, C. M. Miller, J. T. Moore, and E. W. Reisinger and Mr. C. T. Ward; all of whom were elected.

Dr. Lamb, from the Committee on Anatomical Peculiarities of the Negro, reported a 'List of Items' and 'Letter of Instructions' to accompany the same. Dr. Wilder suggested several changes in the terminology, which were accepted by Dr. Lamb for the Committee. On motion of Dr. Huntington, the Association ordered that copies of the report should be printed and distributed among the members for their information and criticism along with the statement that the *terminology* should not be considered as necessarily being that which the Association might ultimately recommend.

On motion of Dr. Huntington, the annual dues were increased to three dollars; the increase to begin with the year 1897–98.

Dr. Huntington, of the Medical Department of Columbia University, New York City, then made remarks on 'Corrosion Anatomy, Technique and Mass;' illustrated by the material and specimens. The subject was discussed by Drs. Wilder and Dawbarn.

Dr. Lamb showed the following specimens and made remarks on the same: Specimen of fissured sternum; two specimens of sterna of young children; an extra carpal bone; bilateral bony ankylosis of jaw; and a penis, showing exaggerated papillæ on corona. Discussed by Drs. Wilder, Dawbarn, Gill, Baker and Huntington.

A paper by Dr. B. B. Stroud, of Cornell University, on 'Comparative Anatomy of the Cerebellum' was, in Dr. Stroud's absence, read by Dr. Wilder. It was illustrated by photographs and charts. Discussed by Drs. Gill, Baker, Huntington and Wilder.

At the meeting on May 5th Dr. Gerrish was elected as a member of the Executive Committee, to fill the vacancy made by the retirement under the constitution of Dr. Gill.

The Secretary stated that after the adjournment the previous day there was a consultation of several members and it was thought appropriate to send to Dr. Allen, who had just undergone an operation for appendicitis, a telegram conveying the sympathy and good wishes of the Association. The Secretary had sent the telegram. On motion of Dr. Wilder this action was approved.

Dr. Wilder then made remarks on 'The Definitive Encephalic Segments and their Designation.' Illustrated by photographs and charts. Discussed by Drs. Gill, Gerrish, Carr, Baker and Huntington. In connection with this subject Dr. J. A. Blake showed photographs of a brain with double precommissure.

Dr. Woods Hutchinson, of Buffalo, read a paper on 'A Possible Morphologic Basis for Diseases of the Lungs.' Discussed by Drs. Huntington and Baker.

The paper of Dr. Stroud on 'Brain Preservation' was read by title.

Dr. Huntington made remarks on 'Ventral Version of Secondary Fore-brain.' Illustrated by photographs. Discussed by Dr. Wilder.

Dr. William Browning, of Brooklyn, read a paper on 'Examination of Spinal Efferents for the Cerebro-spinal Fluid. Discussed by Drs. Wilder and Baker.

Adjourned.

At 5 p. m. the statue of Prof. Dr. Samuel D. Gross in the Smithsonian Park and

near the Army Medical Museum was unveiled with appropriate ceremonies, and at 8:15 p. m. the President of the Congress, Prof. Dr. Wm. H. Welch, of Johns Hopkins University, Baltimore, delivered the Presidential address, which has been published in SCIENCE.

On May 6th the Executive Committee, through the Secretary, reported a recommendation that the next meeting of the Association should be held at Cornell University in December, 1897, in conjunction with the Society of American Naturalists and other affiliated societies. On motion the Association adopted the report.

The President called attention to the fact, that inasmuch as the Congress met every three years, the election for delegate to its Executive Committee every two years seemed to cause some confusion. After some discussion Dr. Hewson moved that hereafter the election for delegate occur every *three* years, and this was adopted. Dr. Wilder, from the Committee on Anatomical Nomenclature, reported progress. Report accepted. Dr. Gerrish, from the Committee auditing the Treasurer's account, reported the accounts correct.

Dr. Huntington made remarks on 'The Cerebral Convolutions of two Brains from Natives of British Guiana.' Illustrated by casts and photographs. Discussed by Drs. Baker and Wilder.

Dr. F. J. Shepherd, of Montreal, showed a specimen of double internal cuneiform bone of right foot of a white woman aged 17; and photographs of hands and feet of same subject, showing multiple digits.

Dr. W. P. Carr, of Washington, showed some anatomical models on a large scale illustrating the circulation of the blood through the heart, the formation of a blood-vessel, and the corona radiata. Discussed by Drs. Wilder, Huntington and Shepherd.

Dr. Blake read a 'Contribution to the Topographical Anatomy of the Mediastinum Superior Theoracic Aperture.' Discussed by Drs. Baker, Wilder and Huntington.

Dr. Addinell Hewson, of Philadelphia, showed the forms of record used in the dissecting rooms of Jefferson College, Philadelphia, Pa., and made remarks thereon. Discussed by Drs. Baker, Huntington, Reisinger and Wilder.

Dr. C. A. Hamann, of Cleveland, showed specimens of congenital malformation of the extremities. Discussed by Drs. Huntington and Geo. T. Kemp.

The Association then adjourned *sine die*.

After the adjournment, at the suggestion of Dr. Kemp, Dr. G. C. Huber, of the University of Michigan, exhibited slides showing the terminal endings of the nerves in the epithelium of the urinary bladder and the sensory nerve endings of the muscle.

D. S. LAMB,
Secretary.

*SYSTEMATIC CLASSIFICATION OF TEXTILE AND OTHER USEFUL FIBERS OF THE WORLD.**

THE advantages of a broader and more systematic classification for textile and other useful fibers has long been appreciated by the author. While engaged in the preparation of a descriptive catalogue of fibers of the world in which over a thousand species of useful fiber plants are enumerated, the necessity for a better classification became apparent, and the scheme herewith presented was devised. The term fiber is popularly understood to relate to those forms of filamentous substance that can be spun and woven, or twisted into cordage, though it should not be employed in so restricted a sense. In fact, many of the true fibers are used in other ways, for there are kinds of cordage, and even cloth substi-

*Abstract of a paper read before the Philosophical Society of Washington, by Chas. Richards Dodge.

tutes, that are neither spun or woven. On the other hand, there are many forms of fibrous substances of the roughest description, such as reeds or shredded palm leaves, that are plaited, this being a coarse form of weaving, so that it becomes difficult to draw the line between a fine spinning fiber like flax, that is woven into linen fabrics, and a sedge, coarsely woven into matting, or a woody twig of Salix plaited into a basket.

In the classification proposed two groups are recognized, based on cell structure. The first, fibers with fibro-vascular structure, embraces three sub-groups, and the second, fibers with simple cellular structure, embraces two sub-groups. The classification is as follows:

A. FIBRO-VASCULAR STRUCTURE.

1. Bast Fibers:

Derived from the inner fibrous bark of dicotyledonous plants or exogens, or outside growers. They are composed of bast cells, the ends of which overlap each other so as to form, in mass, a filament. They occupy the phlöem portion of the fibro-vascular bundles, and their utility in nature is to give strength and flexibility to the tissue.

2. Woody Fibers:

a. The stems and twigs of exogenous plants, simply stripped of their bark and used entire, or separated into withes, for weaving or plaiting into basketry.

b. The entire, or subdivided *roots* of exogenous plants, to be employed for the same purpose, or as tye material, or as very coarse thread for stitching or binding.

c. The *wood* of exogenous trees easily divisible into layers or splints for the same purposes, or more finely subdivided into thread-like shavings for packing material.

d. The *wood* of certain soft species of exogenous trees after grinding, and converting by chemical means into wood pulp, which is simple cellulose; and similar woods more carefully prepared for the manufacture of artificial silk.

3. Structural Fibers:

a. Derived from the structural system of the stalks, leaf stems and leaves, or other parts of monocotyledonous plants or inside growers, occurring as isolated fibro-vascular bundles, and surrounded by a pithy, spongy, corky, or often a soft, succulent, cellular mass covered with a thick epidermis. They give to the plant rigidity and toughness, thus enabling it to resist injury from the elements; and they also serve as water vessels.

b. The whole stems, cr roots, or leaves, or split and shredded leaves of monocotyledonous plants.

c. The fibrous portion of the leaves or fruits of certain exogenous plants when deprived of their epidermis and soft cellular tissue.

B. SIMPLE CELLULAR STRUCTURE.

4. Surface Fibers:

a. The down, or hairs surrounding the seeds, or seed envelopes, of exogenous plants, which are usually contained in a husk, pod or capsule.

b. Hair-like growths, or tomentum, found on the surfaces of the stems and leaves, or on the leaf buds of both divisions of plants.

c. Fibrous material produced in the form of epidermal strips from the leaves of certain endogenous species, as the palms.

5. Pseudo-Fibers, or False Fibrous Material:

a. Certain of the mosses, as the species of *Sphagnum*, for packing material.

b. Certain leaves, the dried substance of which forms a more delicate packing material.

c. Sea weeds wrought into lines or cordage.

d. Fungus growths, or the mycelium

of certain funguses that may be applied to economic uses for which some of the true fibers are employed.

In the portion of the paper which followed, the different forms of fibers were defined in detail and examples given from the list of well-known commercial and native or aboriginal species. It is the consideration of these useful native fibers that makes it possible to enumerate a list of a thousand species of fibrous plants, while the world's commercial fibers would hardly reach a total of fifty species. The native or aboriginal forms are interesting; our museums are filled with manufactures from them, and any scheme of systematic classification which omits them is faulty and imperfect.

CURRENT NOTES ON ANTHROPOLOGY.

PIGMENTATION OF THE SKIN.

M. BREUL, in an inaugural thesis reviewed in *L'Anthropologie*, reports some new observations on the pigmentation of the human skin.

The colors of the different races depend upon this pigment in the epidermis, especially in its deeper strata. Breul finds the coloring matter in the interior of the epithelial cells, while even in the negro the intercellular spaces are white. The pigment itself may be quite black, or of any shade up to a light yellow. It may be confined to the nucleolus, or extend over the cell. A close examination shows that it is distributed in patches over the skin, between them the tissue being colorless. This is true even of the black races, although in them the patches are close together and may not be discernible unless the skin be stretched.

This distribution of the coloring matter is the same in all races, and its actual amount is probably the same, the difference in hue resulting from the darker or lighter character of the pigmentary grains.

HOLMES' RESEARCHES IN MEXICO.

THE second part of the 'Archæological Studies' of Professor William H. Holmes (for a notice of the first part, see SCIENCE, February 21, 1896) is devoted to the 'Monuments of Chiapas, Oaxaca and the the Valley of Mexico.' It is a most attractive monograph, based on original personal studies, and containing nearly forty full-page plates, panoramic views and numerous text illustrations. The ruins described are those of Palenque, Monte Alban (in Oaxaca), Mitla and San Juan Teotihuacan. The volume closes with a series of 'Studies of Ancient Mexican Sculpture,' referring to tablets, yokes, figures and carved shells.

The text is full of new suggestions and comparisons, as well as of facts. The architectural elements of the various sites are analyzed and compared, and the sources from which the materials were obtained were carefully sought out. Nowhere was any evidence found of the use of metals, or a condition of the arts above that known to have existed at the discovery, although the stately monuments of Oaxaca and Teotihuacan testify to an astonishing concentration of effort for prolonged periods. The remains in Mexico are more magnificent in dimensions, but on the whole less artistic than those of Yucatan or Chiapas.

D. G. BRINTON.
UNIVERSITY OF PENNSYLVANIA.

NOTES ON INORGANIC CHEMISTRY.

IN the last *Comptes Rendus* a new atomic weight determination of cerium is described by Wyrouboff and Verneuil. The element was obtained in a state of great purity, and the determinations made by converting the sulfate into the oxid by heat. The atomic weight is given at 92.7, but this is on the supposition that the oxid obtained is Ce_3O_4. It is ordinarily considered that the formula of this oxid is CeO_2, which would

give an atomic weight of 139.05, or about one unit lower than the best previous determination. According to this last weight, cerium is a member of the first series of Mendeleff's fourth group, and to this the oxid CeO_2 corresponds. It is true that many of the properties of cerium do not agree well with this position, but the atomic weight of 92.7 can hardly be brought into harmony with the periodic system, as there is no vacant place between zirconium (90.4) in the fourth group and columbium (93.7) in the fifth group.

E. Chuard, in the *Comptes Rendus*, suggests the use of calcium carbid as a phylloxericide. The presence of phosphorus in the carbid is advantageous, as the phosphocarbid possesses exceptionally powerful insecticidal properties, probably owing to the generation of acetylene rich in phosphin, or possibly containing a phosphorus-carbon compound.

A recent number of *Nature* contains a notice, taken from the Journal of the Russian Physical and Chemical Society, of the death of Dr. Véra Bogdanovskaya-Popoff, who was killed on May 8th in her laboratory at Izhora by an explosion. She had been working to obtain a compound of carbon and phosphorus, analogous to prussic acid, but with phosphorus in the place of nitrogen, and it was while engaged in this dangerous investigation that the fatal explosion occurred.

In a paper read before the Royal Society on June 17th, W. J. Russell describes the action excited by certain metals and other substances on a photographic plate. Experiments showed that uranium salts and oxids act slowly on photographic plates in the dark; this property is shared by metallic zinc, cadmium and magnesium, as well as many other substances, as copal, strawboard, wood, some kinds of paper. This action was at first supposed to be contact action, and then it was thought that in the case of metals minute emanations might be given off. This, however, is negatived by the fact that zinc acts equally well when not in contact with the plate, and even when completely insulated by a coating of varnish.

The June Journal of the Chemical Society contains a paper by Dr. John Ball on the circumstances which affect the rate of solution of zinc in dilute acids, with especial reference to the influence of dissolved metallic salts. It is a familiar fact that the action of pure zinc on sulfuric acid is very slow, but may be greatly accelerated by the addition of certain metallic salts. Platinic chloride is generally used for this purpose, and less frequently a cobalt salt. Dr. Ball finds that with sulfuric acid, magnesium or aluminum sulfate have no accelerating influence, that of chromium, manganese and iron is very slight, silver is greater, while cobalt, copper and nickel sulfates have great influence and in this order. The relative maximum velocity of solution, taking the velocity of pure sulfuric acid as unity, is for the addition of silver sulfate, 9; cobalt sulfate, 18; copper sulfate, 21, and nickel sulfate, 38. In the case of solution in hydrochloric acid the addition of manganese, lead or tin chloride had but little influence, copper somewhat greater (11), while the relative velocities for cobalt, gold, platinum and nickel were respectively 31, 39, 42 and 45. It will be seen that with both acids the addition of a nickel salt causes the greatest acceleration, and the relative order of the different methods is approximately the same, except that copper has much less influence on the solution in hydrochloric acid. Dr. Ball presents no theory of the reaction, but it is a fact worthy of note that in the case of the two metals having most decided influence, nickel and cobalt, it could not be detected that any metal was deposited on the zinc, thus forming a couple.

J. L. H.

PHYSICAL NOTES.

THE 'DARK LIGHT' OF M. LE BON.

DURING the past two years M. Gustav Le Bon has brought out a remarkable fact regarding the passage of light through metals and other so-called opaque substances. This fact, so far as it can be estimated from a study of Le Bon's and others' published results, without resort to confirmatory experimentation, is either that the extreme red or infra-red components of sunlight and of gas light pass through thick metal plates sufficiently to affect sensitive plates after prolonged exposure; or that the medium wave-length components of sunlight and of gas light excite hyperphosphorescence in such metals as copper and lead just as they are known to do in case of uranium as shown by Becquerel. It seems that Le Bon in his experiments has eliminated the effects of direct pressure upon the sensitive film, the effects of temperature and such effects as might be due to chemical action between the film and the metal screens.

In the exposition of his results Le Bon is unsatisfyingly fragmentary and vexatiously notional, and it is amusing, at best, to read his claim of a new connecting region between light and electricity—*la lumière noire.* "Elle ne se propageait peut-être plus comme la lumière et peut-être propageait-elle comme l'électricité." So far as known, 'electricity,' when it is propagated at all, is propagated in a manner identically the same as light, and a fancied difference is of no use in setting forth results. Facts are plain, new facts utterly so, and a discoverer who would have it appear otherwise is either not a discoverer or does not know himself to be one. W. S. F.

SCIENTIFIC NOTES AND NEWS.

THE Weights and Measures (Metric System) Bill passed through the Standing Committee on Trade of the British House of Commons on July 5th, and was ordered to be reported without amendments.

A BRONZE monument of Père Marquette, the priest and explorer, was unveiled in Marquette, Mich., on July 15th.

A MONUMENT in honor of Daguerre, erected by public subscription, was unveiled at Bry-sur-Marne on June 27th.

THE Paris Academy has elected Professor Virchow as a foreign associate in the room of the late M. Tchebitchef. The other nominees were Lord Rayleigh, as second choice, and, as third choice, Professors Schiaparelli, Stokes and Suess.

THE Right Honorable Leonard H. Courtney, M. P., has been elected President of the Royal Statistical Society.

THE Royal Society of Edinburgh has awarded the Gunning Victoria Jubilee Prize to Mr. John Aitken, the Keith Prize to Dr. Kargill G. Knott, the MacDougall-Brisbane Prize to Professor J. G. M'Kendrick and the Neill prize to Mr. Robert Irvine.

IT is stated in the Washington *Star* that M. Zolla has been sent to America by the French government to study methods of agriculture.

THE subject of the essays for the Howard Medal and Prize of the Royal Statistical Society for 1898 is 'The treatment of habitual offenders, with special reference to their increase or decrease in various countries.'

A MEETING was held on July 2d, at University College, London, to inaugurate the memorial to the late Sir John Pender, to which we have already referred. Remarks were made by the chairman, the Marquis of Tweeddale, by Mr. Haldane and by Lord Kelvin. A check for £5,000 was presented by the chairman to the authorities of University College to endow the electrical laboratory, and the bust of Sir John Pender was exhibited. Lord Kelvin spoke of what Sir John Pender had accomplished. When the first experiment was made to lay a cable across the Atlantic, Sir John Pender was one of the directors of the company. When the temporary success was followed so soon by

failure, the directors resigned one after the other, and it was due to Sir John Pender alone that the undertaking was not abandoned in the period from 1858 to 1864.

WE regret to record the deaths of Samuel Brassai, professor of mathematics at Klausenberg, at the age of one hundred years; and of Dr. H. Wankel, of Olmütz, known for his researches in anthropology and archæology.

THE Librarian of Congress has made several excellent appointments, but has offered the position of chief of the art department of the Congressional Library to a newspaper correspondent. It is, perhaps, thought that connection with the New York *World* gives an adequate training in modern art.

THE government of La Plata has made arrangements for securing the services of a bacteriologist whose duty it shall be to make an experimental study of tropical epidemics.

MESSRS. KADY, Berg and See, architects, have submitted to the Department of Buildings, New York, plans for two additions to the American Museum of Natural History, one a lecture hall at the north end of the Museum to cost $150,000, the other a six-story building attached to the west wing to cost $400,000.

THE Boissier Herbarium at Chambésy, near Geneva, which recently acquired the books on lichens and the dried specimens of the late Dr. J. Müller, is, according to *Natural Science*, following the example of the trustees of the Tuckerman Memorial Library of Lichenology, Amherst, Mass., and has established a 'Lichenotheca Universalis Müller-Argau.' The curator, M. Eugene Autran, appeals to botanists for copies of publications bearing on lichens and also for specimens of new and rare species.

THE Prince of Wales Hospital fund had, up to the beginning of the present month, received donations amounting to about £130,000 and promises of annual subscriptions amounting to about £2,500. The hospital Sunday fund is, however, this year smaller than usual. It is stated that Americans resident in England have endowed with £1,000 each beds in five London hospitals, to be used in the first instance by Americans.

SIR ANDREW NOBLE has given £100 to the Royal Institute, London, for the fund for the promotion of experimental research at low temperatures.

THE State Department has transmitted to Congress a copy of the note from the Minister of Norway and Sweden, inviting the United States government to participate in the International Fisheries Exposition to be held at Bergen, Norway, May 16th to September 30, 1898, with a recommendation that an appropriation be made for this purpose.

THE seventh annual meeting of the Paris Society of Hypnotism and Psychology was announced for July 19th, under the presidency of M. Dumontpallier.

THE eighteenth annual meeting of the German Anthropological Society will be held from the 3d to the 5th of August at Lübeck. Excursions are arranged to Schwerin and to Kiel on the days following the meeting.

THE Board of Directors of the American Chemical Society have authorized the establishment of a local section at Columbus, O., the necessary steps having been taken as required by the constitution of the Society.

IT can scarcely be hoped that the letter addressed by the Secretary of State to the Ambassador at London, and for some inexplicable reason published in the daily papers, will conduce to a scientific solution of the question of the results of pelagic sealing in the Bering Sea. It is unfortunate when scientific testimony is used for conflicting political interests. It would apparently have been best for the British and American scientific experts to have drawn up a joint report containing only the facts on which they were agreed.

THE daily papers contain accounts of the arrival of a steamship from the Yukon district of Alaska, reporting great success in the Klondyke gold fields. It is reported that single individuals have taken out in two and a-half months more than $150,000 in gold.

THE steamer Svensksund has reached Norway from Spitzbergen with the news that Herr Andrée and his companions began their voyage on July 11th, at 2 : 30 p. m. The balloon was carried in a northeasterly direction.

A CONFERENCE was held in the rooms of the Royal Geographical Survey, on July 5th, for the purpose of promoting Antarctic exploration. The chief object of the meeting was to bring the matter to the attention of the Australasian Premiers, then in London, with a view to inducing them to secure from their governments contributions toward a British Antarctic Expedition, under the auspices of the Royal Geographical Society. Sir Clements Markham, President of the Society, the Duke of Argyle, Sir Joseph Hooker and Professor Rücker made addresses urging the great scientific importance of exploring the South Polar regions. The Australasian Premiers were, it appears, unable to be present, but replies were made by representatives of New South Wales, Victoria and New Zealand, favoring the plan. The President said that he had been authorized to state that the Council of the Society would contribute any sum up to £5,000 which the colonial governments might subscribe.

THE London *Times* states that Sir Martin Conway and Mr. E. J. Garwood left London on June 29th for Spitzbergen, in order to continue the exploration of the interior of the main island begun by them last year. They are to be landed at King's Bay, whence they hope to make sledge expeditions over the northern ice sheet. Afterwards they intend to revisit Horn Sound and complete the scientific exploration of the southern peninsula.

THE London correspondent of the New York *Evening Post* cables that Mr. George Murray, keeper of botany in the British Museum, has proceeded to Panama at the instance of the government grant committee of the Royal Society for researches on little known pelagic algæ. During the voyage these organisms will be obtained by pumping sea water through fine silk tow nets.

MR. GEO. H. ELDRIDGE, of the Geological Survey, has completed the field investigation of the phosphate deposits of Florida, and returned to the Washington office to prepare his report. This investigation was one of considerable magnitude, Mr. Eldridge having spent one year and nine months in actual field work.

THE Peary party includes, through arrangements made by Professor C. D. Walcott, Mr. Chas. Schuchert, from the U. S. National Museum, and Mr. C. David White, from the U. S. Geological Survey. They will disembark at Disco Island, off the western coast near the 70th parallel, and this island and the mainland immediately adjacent will be their field of work. Mr. Schuchert, who is in charge of the Department of Invertebrate Paleontology in the National Museum, will go in quest of Mesozoic and Tertiary fossils, and Mr. White, who is one of the paleobotanists of the Geological Survey, expects to make a large collection of the Mesozoic and Tertiary plant remains of the region visited. America has thus far secured but meager collections of polar fossils, Europe being far ahead in this regard. Mr. Robert Stein, of the Geological Survey, also accompanies the expedition, but not as an official representative of the bureau. He will leave the party at Wilcox Head, from which point he expects to make a survey of the coast north of Devil's Thumb, toward Melville Bay.

M. MAREY has contributed to the Paris Academy an account, by MM. V. Tatin and Ch. Richet, of trials of an aëroplane invented by them. Their first experiments were made in 1890, but the machine was wrecked. A new machine was then constructed, with which the first trial was made last year with some success. In a second trial in June last the aëroplane travelled through the air 170 m. at the rate of 18 m. per second. The machine weighed 33 kg. The authors compare their results with those obtained by Professor Langley, and, while admitting the greater distance traveled by the aerodrome, claim that their machine had the advantage of greater weight and greater speed.

AT the Royal Naval Review the performances of the *Turbinia*, a boat in which the Hon. C. P. Parsons has made use of the steam turbine for marine propulsion, excited much attention. It steamed at a speed of 34 knots an hour, and it is said that even yet the full power has never been applied.

AT the recent International Congress of Publishers at Paris the inexactness of designating the size of books as 4°, 8° and 12° was dis-

cussed, and a resolution was passed to the effect that catalogues of publishers should give the actual sizes of volumes in the metric system.

THE second interim report of the departmental committee appointed by the British Home Office to inquire into and report on certain dangerous trades has just been issued as a Parliamentary paper. This report, which is signed by all the members of the committee, including the additional member, Mr. C. V. Boys, F.R.S., deals with electrical generating works. According to the London *Times* the committee has framed several regulations which they recommend should be applied in all cases where electricity at high pressure—a direct current of 700 volts or more, or an alternating current of 350 volts—is in use. The recommendations include the following regulations: The frames and bed-plates of all generating machines shall be efficiently connected to earth. The rails fencing dynamos or other generating machines shall be made of wood or other non-conducting material. The floors of all places where it would be possible to make connection with metal at high pressure should be covered with an insulating mat of suitable material and kept in a state of efficient insulation. In switchrooms and on the front of switchboards the main switches, main fuses, main terminals, omnibus bars and all other metallic parts shall be insulated or arranged in such a manner as to render it impossible for any person by accident or inadvertence to touch them. All switchboards erected after the application of these rules shall have at the back a clear space of at least four feet. This space shall not be utilized as a store room or lumber room, or be obstructed in any manner. Any person at work upon a cable or portion of the mains under high pressure shall wear india-rubber gloves on both hands, and the gloves shall be supplied by the occupier, and it shall be the duty of the manager to see that they are in a proper state of repair and are worn by the work people.

THE twenty-second annual report from the Savilian professor of astronomy at Oxford, Mr. H. H. Turner, is published in the *University Gazette* for June 23d. It is stated that the measurement and reduction of the plates for the Astrographic Chart has been the staple work of the year. The Royal Society having granted £150 from the government grant fund during the year, four or five boys who have just left school have been engaged to carry out the measures and reductions under the supervision of the assistants, and the experiment has been successful, one-tenth of the whole work having been accomplished in the last six months. The need of a residence at the observatory pressed on the attention of the board at their last meeting, and fully recognized by them, has not been acknowledged by the Hebdomadal Council. In journeying across America to and from Japan, in order to observe the total solar eclipse of August 9th, the Astronomer Royal, Captain Hills, R. E., and Professor Turner took the opportunity of visiting several Canadian and American observatories. Professor Turner acknowledges the courtesy shown to him, especially at Montreal, Chicago, Cambridge and Washington. "It would be ungrateful not to add that what we saw was of immense value to us, in the way of suggestion; the ideas acquired at the Harvard observatory alone were worth the journey, and cannot fail to leave their impress on the work here."

THE report of Dr. Gill for the year 1896, to the Lords Commissioners of the Admiralty, is abstracted in a recent issue of *Nature*. The McLean telescope is expected to be completely installed and in full working order before the end of the present year. During the last few years Dr. Gill has somewhat necessarily restricted the amount of observational work in order to make more progress in the computation and publication of many arrears, and it is satisfactory, then, to hear that it has now become possible to again resume a program of activity. Several important publications have been concluded in the last twelve months. Among them may be mentioned Vol. II., containing a determination of the solar parallax and mass of the moon, from observations of Iris, Victoria and Sappho, made in the years 1888 and 1889. Vol. I. is also practically complete. The first volume of the Cape Photographic *Durchmusterung* is also ready for distribution, Vol. II. being in course of printing. The observational work with the transit circle, equatorials and astro-

photographic telescope has been very considerable, and it may be mentioned that all the catalogue plates, with the last-mentioned instrument, have now been obtained. Out of the 230 chart plates, 169 have been satisfactorily exposed. The 7-inch equatorial has also been very busy in the hands of Mr. Innes, and, besides several new variables, 104 new double stars have been discovered. Dr. Gill refers also to the increase in staff and the necessity for a reversible transit circle for refined fundamental work, and mentions that these proposals have been favorably considered by the Lords Commissioners of the Admiralty and of Her Majesty's Treasury.

A CONVERSAZIONE was given by the President and Council of University College, London, on June 30th. According to the account in the London *Times* there were a large number of interesting exhibits. Professor Percy Gardner showed a series of archæological photographs, and Mr. Seton-Karr the interesting collection of flint implements recently discovered by him in Somaliland and Egypt. In the mechanical engineering laboratory all the machinery was in motion, besides a number of machine tools lent by various firms. In the electrical laboratory Professsor Elisha Gray's writing telegraph, by which writing may be transmitted long distances, was shown in operation by the Telautograph Company. Messrs. Harvey and Peek gave an exhibition of Tesla experiments with high-frequency currents, and Mr. J. W. Swan sent some of his experiments on electrical discharges against insulators in which curious frond-like figures were produced by the electric spark, and also a delicately-poised Gramme ring which rotated under the influence of the earth's magnetism. In the applied mathematics department apparatus and diagrams were on view illustrative of the work done and the methods of study pursued. These included various calculating machines, instruments for finding areas, and models illustrating games of chance and statistical variation and correlation. There was also a fine collection of books (mainly from the Graves Library of University College) and of portraits illustrating the history of pure and applied mathematics. In the physical lecture room experiments were shown with Hertzian waves and with the magnetic deflection of cathode rays, while Professor Ramsay exhibited the spectra of argon and helium. Some beautiful collections of begonias, orchids, roses and other flowers were to be seen in the anatomical museum, together with a collection of dwarf Japanese trees, some of them being a century old and yet only a foot or so high. Not the least attraction of the evening was Professor Flinders Petrie's exhibition of Egyptian antiquities, which includes the results of recent excavations at Deshasheh, Behnesa and El Kab.

IN one of the Harben lectures given on June 30th, at Kings College, London, Dr. Sims Woodhead discussed the antitoxin treatment of diphtheria. The London *Times* states that he showed examples of the degeneration of tissue produced in various organs of the body, even so soon as the third or fourth day of the disease, and pointed out that after these changes had occurred the physician could not expect to bring the patient back to health at once. This consideration explained the diminished curative power of the antitoxic serum in the latter stages of the disease. The life of a patient depended on the tissues being able to carry on their work, and they could do this if the action of the toxin on their cells could be prevented. In the presence of both toxin and antitoxin these dreaded organic changes did not occur. Hence, if a patient was to recover, antitoxin must be present, whether it was formed within the body or injected from the outside. The serum had both a preventive and curative action, and he would not hesitate to recommend its use as a prophylactic for people exposed to infection. As regards its remedial use the question of time was most important. The necessity of an early exhibition of the serum was illustrated by some statistics. In 1894, before the antitoxin treatment was adopted, the mortality of cases of which the treatment was begun on the first day of the disease was 22.5 per cent.; in 1896 it fell to 4.7 per cent. Of cases of which the treatment was begun on the second day the percentage of mortality decreased from 27 in 1894 to 12.8 in 1896, while in those which came under treatment in the third day the mortality was 29.4 in 1894 and 17.7 in 1896. Even in cases which were neglected till

the fifth day the antitoxin treatment effected a reduction of 6.2 per cent. in the mortality. In view of these figures, and of others dealing with the death-rate in post-scarlatinal and laryngeal cases, Dr. Woodhead expressed his strong conviction that those who opposed the use of the remedy assumed a tremendous responsibility.

MR. ALEXANDER WATT contributes to the last number of the *Bulletin de l'Institut International de Bibliographie* (why should a journal devoted to bibliography omit the date of issue?) an account of a new form of card catalogue. The usual plan of arranging a card catalogue is to place the cards in a drawer or box, a rod being run through the holes in the cards to keep them in their proper order. The examination of the catalogue is made by turning over the cards as one would turn the leaves of a book if it were laid upon its back with its fore-edge in front of the examiner. There are several inconveniences arising from this method of keeping cards. (1) A special cabinet of drawers or boxes is required. (2) As the drawers are bulky and expensive they are generally made too large (to reduce the bulk and expense), which prevents the catalogue being consulted by more than one or two persons at once. (3) It is difficult to keep a particular card in view during the copying of a title, and only one card can be readily seen at a time. In order to obviate these disadvantages Mr. Watt has devised a new receptacle for holding the cards, consisting of a case made in the form and of the materials of the boards of a book. The cards are placed between the boards of the case and are held in position by means of a pin passing through the *outer* corner of the cards and case. The pin, which is made to exactly fit the hole in the cards, has a fixed hole at one end and at the other end a head which screws into the pin. The cards during examination, instead of sliding along the pin, are rotated on it outwards *en bloc*, and may be spread out in the form of a fan so as to keep in view several cards at the same time. As the cards are examined they are pushed back into the case, one or more at a time. As the cases (which may be made of any thickness) when full of cards look like ordinary books they may be arranged like them on the shelves, and as they can be made very cheaply the catalogue of a library may be split up into hundreds of volumes, which will thus allow of its being consulted by many persons at the same time.

THE *Engineering and Mining Journal* has compiled its fifth annual volume on the mineral industry of the United States, giving statistics for the year 1896. The total value of the production was \$706,015,411, an increase of \$23,950,293 over the preceding year. The United States in 1896 was the largest gold producer of the world and the largest silver producer; it was also by far the largest producer of copper, furnishing over one-half of the world's supply of that metal. Notwithstanding the decrease in the pig iron output it was still larger than that of any other country. In coal the total was still less than that of Great Britian, though it is gradually approaching the point where the two will be equal. The editor writes: "In accordance with our usual custom, we have added to the usual measurements of quantities in each case the metric measures, which we earnestly hope will soon be the only legal measure in this country, as they already are in nearly every other civilized country."

THERE was recently an interesting debate in the British House of Lords regarding works of art and the finance act. A clause in that act enacted last year reads as follows:

"Where any property passing on the death of a deceased person consists of such pictures, prints, books, manuscripts, works of art, scientific collections, or other things not yielding income as appear to the Treasury to be of national, scientific or historic interest, and is settled so as to be enjoyed in kind in succession by different persons, such property shall not, on the death of such deceased person, be aggregated with other property, but shall form an estate by itself, and while enjoyed in kind by a person not competent to dispose of the same be exempt from estate duty; but if it is sold or is in possession of some person who is competent to dispose of the same shall become liable for estate duty."

This clause it appears has been interpreted so as to include only works of art, illustrating English history. It is not clear whether scientific collections must also be confined to English history in order to be exempted from death dues. It was claimed in the debate in the

House of Lords that the tax leads to the dispersion of art collections, pictures being exported from England to the value of $6,000,000 annually.

THE *British Medical Journal* states, on the authority of the Secretary of the Pretoria Agricultural Society, that Professor Koch's results with rinderpest inoculation are better than usually stated to be. He says that the method carried out in hundreds of instances has proved successful, but the unfortunate part has been that the ignorant Boer has not carried out all the particulars as instructed. He knew of one instance in which a Boer, after inoculating an animal with the virus, actually cleaned his fingers on the back of the nearest one grazing. In his opinion, however, it is not quite possible to stamp out the disease by the method, as it is impossible to inoculate throughout South Africa the hundred thousands of heads of cattle belonging to the natives in isolated districts in various parts of the country, and this contagious virus is, moreover, carried by the aasvogels (a species of vulture), who feed on the carcasses and carry the rinderpest from farm to farm.

IT is stated in *Nature* that a botanical society has recently been established at Perth, West Australia, and has been given the designation of the Mueller Botanic Society, as a tribute to the memory of the late Baron von Mueller, who spent the best part of his life in investigating the plants and other products of Australia. Sir John Forrest has been elected President of the new Society; Mr. Wittenoom and Mr. Leake, Vice-Presidents, and Mr. Skews, Secretary.

THE Auckland Institute, says *Natural Science*, has decided to add a new hall, 50 feet square, to its Museum, on the east side of the Ethnographical Hall. It is intended to receive the statuary presented by Mr. T. Russell, which has hitherto found an uncongruous home among stuffed vertebrates. The space thus gained will be occupied by groups of the larger mammals, and £100 offered by Mr. Russell will be used to procure a group of the larger carnivores. Little Barrier Island, on which an attempt is being made to preserve the indigenous fauna and flora of New Zealand, has been placed under the control of the Institute, with a grant of £200 for the first year's expenses. Mr. R. H. Shakespear has been appointed curator, and it is hoped that he may be able to stop the depredations of collectors.

UNIVERSITY AND EDUCATIONAL NEWS.

IT is announced that a college for women under the auspices of the Roman Catholic Church will be established at Washington. It will be called Trinity College, and will be adjacent to the Catholic University of America.

THE municipal council of Marseilles has passed a resolution favoring the establishment of a university in that city.

MR. C. L. HERRICK, lately professor of biology at Denison University, has been elected President of the Territorial University at Albuquerque, New Mexico.

DR. A. R. HILL has been appointed professor of psychology and ethics in the University of Nebraska, and Dr. E. L. Hinman has been promoted to an adjunct professorship of philosophy in the same University.

MISS BERTHA STONEMAN, who has been engaged for several years in the study of the development of fungi in the botanical department of Cornell University, and who received last year the degree of Doctor of Philosophy, has been appointed professor of botany in the Huegenot College in Cape Colony, South Africa. This is a college for the education of the daughters of the French and Dutch Huegenots and English residents in South Africa. She sails from New York on Saturday, July 24th, for Liverpool, and thence by the British African line of steamers for South Africa.

MISS ARMA ANNA SMITH, M. S., and Miss Ethel Muir, Ph.D., both of Cornell University have been appointed assistants in Mount Holyoke College, South Hadley, Mass., the former in botany and the latter in philosophy.

MISS ELLEN HAYES, for the past nine years professor of mathematics in Wellesley College, has just been made professor of applied mathematics in the same College. The courses of

study conducted by Miss Hayes include mechanics, thermodynamics, geodynamics and theoretical astronomy.

PROFESSOR HUGO DE VRIES, of Amsterdam, has been called to the chair of botany in the University of Würzburg as successor to the late Professor J. Sachs. In the same University, Professor Ph. Stohr, of Zurich, has been appointed professor of anatomy in succession to Professor v. Kölliker, who will hereafter confine himself to histology and embryology. Dr. Salomon has qualified as docent in geology and mineralogy in the University at Heidelberg.

DISCUSSION AND CORRESPONDENCE.

NEW TERMS IN GEOLOGY.

PROFESSOR DAVIS, speaking in behalf of new terms in geology and geography (SCIENCE, July 2, p. 24), makes the following points: that new terms are necessary to any advancing science; that new things and new ideas must have new names, and that the investigator must be left as free to name his conclusions as to reach them. He mentions some terms introduced by Powell in 1874 as examples of useful ones, and others of later introduction which he expects to see survive; at the same time he admits that he has been not a little amused at watching the rest of us 'wrestle' with new terms.

These contentions seem at first glance to be altogether reasonable. But that new terms are demanded by an advancing science is admissible only in a limited sense. The discovery of new elements, new materials, new biologic forms, all call for new names. To these no one thinks of objecting. Aside from such cases, what book published in the last fifty years has contributed more than any other to the advance of science all along the line? Darwin's 'Origin of Species.' And how many new terms did Mr. Darwin use? Not one—if we except such an expression as 'natural selection.'

The newest science of which I have any knowledge is that now being remarkably developed by Dr. Charles H. Gilbert, of Stanford University, in studying geographic and geologic changes by means of the fish faunas. And I venture to say that his splendid results will eventually be brought forth, not dressed in the paraphernalia of a new terminology, but without the use of a single new expression.

It certainly does not follow, then, that an advancing science and new ideas must, of necessity, have new names.

As for freedom to name one's conclusions, I would ask: Is this naming a matter that concerns the finder alone, or does it concern every one who has to do with the science? Are facts and conclusions private property to be named, like one's dog, as the owner happens to fancy, or are they a part of science, and to be named with some reference to those who may have to use them?

Mention is made of certain geographic terms that are expected to prove useful. I may specify one of these—*Cuesta* (Spanish for the flank or slope of a hill, but also used for a hill itself)—as the kind of a word which, in my opinion, is not demanded either by the necessities of an advancing science, or as representing a new idea. And if we see fit to name one kind of a hill *cuesta*, with just as much reason we may baptize with new technical names all the different parts, kinds, sizes and shapes of hills on the face of the earth, while students may be asked to fill their bellies with these husks of science under the impression that they are necessary parts of the science itself. Everyone remembers the story of Agassiz setting a new student to study a case of birds, and how, when he reported a few hours later that he knew all of their names, he was told to forget the names and to go back and study the birds.

But the main point is whether such things advance knowledge or serve important purposes in that advancement. When Mr. Gilbert described certain structural features of deep-seated igneous rocks he advanced our knowledge, and when he gave us a rational name by which to call those hitherto unknown forms he gave us a label for that knowledge. But it hardly follows from an instance of this kind that forms and structures that geologists have long known and comprehended should be given new names either from the Spanish or from any other language. We shall not understand a synclinal mountain any better by calling it a 'Shickshinny.' It is hardly a case of new bottles needed for new wine.

Terms that save men's time and nervous energy are helpful and welcome; those that consume time and energy without adequate return are 'useless incumbrances.' For this is a pretty busy world, and as many of us are anxious to keep pace with what is going on in geology and geography we often feel impelied to say to contributors, as we do to callers at the the office during business hours: "Be plain; be brief."

Local names serve good purposes with students who are obliged to get their ideas of geology from local illustrations, but such names should be kept at home; in the general literature of the subject they are what the European geologists call them.

One's feeling the need of a new term, or his having found one 'serviceable in his lectures during the past winter,' are certainly not of themselves sufficient reasons for introducing them to the public.

Technical names are a necessary evil, and new ones cannot be avoided; but it is our duty to increase this evil as little as we can, and only after duly weighing the pros and cons of each case. JOHN C. BRANNER.

STANFORD UNIVERSITY, CALIFORNIA,
July 12, 1897.

NOTES ON SOME FOSSILS OF THE COMANCHE SERIES.

THE description and figure of *Turritella leonensis* given by Conrad in the Report of the Mexican Boundary Survey implies that all of the whorls of the shell in that species are rounded. In my 'Description of Invertebrate Fossils from the Comanche series in Texas, Kansas and Indian Territory' (Colorado College Studies, V), I described *Turritella denisonensis* from the Choctaw limestone of northern Texas, noting its resemblance to *T. leonensis*, but separating it from that species on the ground of the much enlarged and angulated, or shouldered, body-whorl. In 1895 Mr. R. W. Goodell brought some fragmentary but interesting specimens of *leonensis* from the Trans-Pecos region of Texas, whence came Conrad's types of the species. One of these shows the body-whorl to be enlarged and shouldered as in *denisonensis*. I therefore suspect the latter to be a synonym of *leonensis*. As the northern specimens have been found in both the Choctaw and Grayson members of the Denison formation, while there is reason to believe that Mr. Goodell's specimens are from the Washita formation, it is probable that *Turritella leonensis* ranges throughout the entire Gainesville division.

In 1893, in the Fourth Annual Report of the Geological Survey of Texas (Part II., page 232), the writer noticed a shell that had been collected by Mr. L. S. Williams from 'drift,' in northern Texas, briefly characterizing it as a variety of *Turritella seriatim-granulata* and assigning to it the name *ventrivoluta*. Our first positive knowledge of the stratigraphic place of this shell is afforded by a fine specimen which the writer found in 1893 (only a few months after the original notice of the shell had been published) near Belvidere, Kansas, in the lower part of the Kiowa shales, viz., the Fullington beds, which correspond more or less nearly with the Kiamitia of Texas. The specimen is complete, and the half which is free from the matrix affords an apertural view of the shell in its entire length. The ornamentation is well preserved and, taken in connection with the other characters, shows that the shell is very distinct from *T. seriatim-granulata*. Like the latter species, it belongs to the subgenus *Mesalia*, and should be known as *Turritella* (*Mesalia*) *ventrivoluta*.

Turritella belviderei, sp. nov.—Shell of medium size in the genus, consisting of ten or more flattened or somewhat convex whorls; suture feebly impressed; aperture round-rhombic, slightly elevated; whorls ornamented with about six subequal to unequal, abruptly elevated revolving ribs whose summits are beaded, each bearing a rather closely-set series of oblique to transverse prominent granules; the intercostal intervals square-bottomed, those of the upper spire-whorls and of the lower parts of the body-whorl and first spire-whorl wider than the ribs, those of the upper parts of the body-whorl and first spire-whorl respectively less than and about equal to the ribs; upper rib and tubercles of each whorl usually coarser than the others, especially so in the case of the body-whorl, in which the large tubercles are sometimes distinctly arcuate (concave on the side away from

the aperture), an attenuated rib, or raised line, (sometimes two) developed just above it, about on the suture, the second rib above this being also sometimes smaller than the average.

Measurements.—Hight 45 to 60 mm.; breadth of body-whorl 17 to 20 mm.; divergence of spire-slopes (variable) commonly between 18 and 23 degrees.

Occurrence.—In the Kiowa formation at Belvidere, Kansas. It is the common Turritella of this formation, and is very abundant and well preserved in limestone bands in the Fullington horizon at that locality. Specimens preserved in the carbonaceous clay-shale parts of this horizon are usually found crushed.

This shell has hitherto been cited generally under the name, *Turritella seriatim-granulata*, but is distinct from that species as described and figured by Roemer.

I have elsewhere listed as '*T. marnochi*' and '*T. seriatim-granulata*, var. *marnochi*,' a large Turritella which is common in the Champion shell-bed at Belvidere. Recently, I submitted to Mr. T. W. Stanton, of the United States Geological Survey, specimens of the shell so listed. Most of these were returned without comment; but one, whose only differences from the others seem to fall within the individual variation of the species, was returned with the comment, "This specimen is more like Roemer's type of *seriatim-granulata* than any other I have seen, the chief difference being its larger size. Comparison was made with a squeeze from the original." Since all of these specimens agree in general character of ornamentation with *seriatim-granulata* as represented by Roemer in his Kreidebildungen von Texas, and since, at the same time, there is in many of them a tendency to that elongation of the granules which Dr. White represents for his *Turritella marnochi*, it seems altogether probable that the original *marnochi* and the large Turritella of the Champion shell-bed that I have hitherto referred to *marnochi* represent one and the same species, the *Turritella seriatim-granulata* of Roemer.

A careful study, recently made, convinces me that the common *Turritella* of the Kiowa shales, to which, in Bulletin No. 11 of the Washburn College Laboratory of Natural History, I applied the varietal name, *belviderei*, should be recognized as a species distinct from *seriatim-granulata*, and I have accordingly described it as such under the name thus early applied to it.

Omitting common points, the two species may be characterized for determinative purposes as follows:

T. seriatim-granulata. (Including *T. marnochi*, apparently as an individual variation.)

Size large; granules mostly well interspaced, coarse, appearing as small, low, rounded tubercles, or elongate with the trend of the revolving costellæ, both forms of granules often appearing on the same specimen and in variable proportion.

T. belviderei.

Size usually smaller; granules finer, prominent, numerous and crowded, their greatest diameter either transverse to costellæ or oblique.

So far as I am aware, there is no conclusive evidence of inter-gradation of the two types, though there is variation in both.

But here arises the question of the relation of *Turritella belviderei* to Meek's *T. kansasensis*, of the Mentor beds. The latter species, which attains a much larger size than is credited in the original account of it, is described as if ornamented with simple linear revolving ribs. As usually indicated by the mould, it is so ornamented; but in some instances there are traces of granules on the ribs, though only of feeble ones so far as yet observed. Aside from their summit-form, the ribs have the same characters as those of *T. belviderei*, viz., abrupt elevation, square-bottomed intervals, etc. The sinuous trend of the growth-lines in this species is found also in *belviderei* and *seriatim-granulata*. *T. kansasensis*, as now known, has the ribs plain or nearly so. But the moulds sometimes seem to be coated with a ferruginous film which may have obliterated distinct granules if such were originally present; and the query arises whether new and better material might not show strongly granulated ribs, and *belviderei* so become a specific or varietal synonym of *kansasensis*. At the same time, it is certain that in many Mentor fossils the moulds preserve the impress of the surface-sculpture in its finest details.

An apparent difference of ornamentation like that between *Turritella kansasensis* and *T. belvi-*

derei exists between the Mentor fossil, *Margarita mudgeana* Meek, and the Kiowa species, *M. marcouana* nobis; and here also it remains to be shown whether the difference is genuine or due to unlike conditions of preservation.

I have recently identified *Nerinea acus*, Roem., from the Champion shell-bed at Belvidere, the markings shown as in Roemer's figure of the type. This, with the *Lithophagus* noticed below, brings the total number of Invertebrata known from this thin but remarkable shell-bed up to thirty-eight. This interesting occurrence of *Nerinea acus* further confirms Professor Hill's earlier and my own constant later reference of the Champion shell-bed to the Fredericksburg formation, and to the Comanche Peak limestone in particular; and the occurrence of the *Lithophagus* in both the Champion and the Kiowa not only adds to the former evidence of a closely successional time-relation of the two formations, but also tends to emphasize the conclusion I have elsewhere announced, that the Kiowa is about equally related to Fredericksburg and Washita.

The *Lithophagus* referred to is one of which I found several specimens in burrows in Serpula-knots in the Champion shell-beds, and which is assumed not to differ specifically from the '*Lithophagus* sp. nov.' of Stanton, reported (in Hill's 'Outlying Areas of the Comanche Series in Kansas, Oklahoma and New Mexico;' Am. Journ. Sci. 3rd Series, Vol. L), as occurring in Gryphæa-valves in the Hill and Gould collections from the Kiowa shales at Belvidere, borings similar to those in the Serpula having been found by the writer in Gryphæa-valves at the zone of transition from the Black Hill shale to the Fullington bed, a horizon intermediate in position between the two which have yielded the actual shells of *Lithophagus*.

In 1893 I collected in the Comanche Peak limestone of south-central and north-central Texas several specimens of an apparently undescribed, heavy-ribbed species of *Cyprina*, to which I have given the manuscript-name *Cyprina laticostata*. I now recognize as belonging to this new species the cast which, in my 'Study of the Belvidere Beds,' I referred to *Homomya alta*, Roem. Thus the evidence for reference of the Champion shell-bed to the Comanche Peak limestone of the Fredericksburg division continually becomes clearer.

Stratigraphic Names for Caprina and Caprotina (or Requienia) Bearing Beds of Northern Texas. In defining the Barton Creek limestone, a member of the Fredericksburg formation (*American Geologist*, XVI., 385), I fell into the error of including in it both the Caprina limestone and the Caprotina limestone of Shumard, whereas it was the former only (whose fauna includes both *Caprina* and *Caprotina*, or *Requienia*, with other genera of *Chamidæ* and *Hippuritidæ*) that should have been included in the definition, and which was especially intended, this being the limestone that succeeds the Comanche Peak limestone, on Barton creek, in Travis county, Texas. It is the cap-rock of a number of buttes that carry remnants of the Fredericksburg formation in central and western Texas. The Caprotina limestone of Shumard is the Caprotina or Requienia bed that occurs in the upper Glen Rose, in the Brazos Valley, in the vicinity of Granbury, and which may be designated as the *Granbury bed*, to distinguish it from more or less similar beds elsewhere. Since proposing the name Barton Creek for the Caprina limestone of the creek thus named, I have observed that the name is quite similar to that of the Barton clays (Tertiary) of England. The similarity is the more unfortunate because increased by my inadvertently referring to the Texas bed in a shorter form, 'Barton,' in formally defining it, immediately after having defined it in table as 'Barton Creek.' Altogether, the considerations stated probably render either 'Barton' or 'Barton Creek' untenable, and both terms are therefore here abandoned in favor of another. The same bed of Caprina limestone that occurs on Barton creek may be seen overlying the Comanche Peak limestone, in Stonewall county, Texas (where, as Messrs. Dumble and Cummings have shown, and as the present writer has later observed, it forms the cap-rock of Double mountain); and the name *Stonewall limestone* is therefore here proposed for it.

F. W. Cragin.

Colorado College, Colorado Springs, Col.,
May 28, 1897.

OYSTERS: A REVIEW OF IGNORANCE.

ONE of the greatest services which science is doing for the world is the exposure of ignorance, and the inculcation of the doctrine that a thorough groundwork of the rudiments of general science should be laid by those who aspire to teach or to practice medicine, and it should be appreciated by the public that those alone who possess it are worthy of confidence.

In illustration of the actuality of the need, and partly as a review of the question concerned, I will criticise a leading article contained in a journal called *Modern Medicine and Bacteriological Review*, which purports to show that the oyster must be abandoned as a food.

This article begins by reciting the plenteousness of bacteria in the oyster, and says it is "a creature whose diet consists of the offal of the ocean, and which lives upon material so filthy and noxious in character that it requires the unceasing activity of a liver constituting nearly one-half the bulk of its body to protect it from impending death." It then cites the cases of typhoid fever traced to the oyster, quoting the *British Medical Journal*, which comments on the need for supervising the oyster beds; and then the editorial remarks that the beds are usually seated in the mouths of rivers and bays: "The oyster is fond of typhoid bacilli; it eats them as a tidbit; it will not miss a chance of swallowing millions of these mischief-making germs if opportunity is afforded. Indeed, this is the very business for which nature designed the oyster. It feasts upon the slime and ooze which covers the ocean's bed, near the shore, and the seaweeds which grow in such localities. The oyster has neither teeth nor claws with which to tear and masticate solid food. It is designed to live on the decomposing germ-infected substances which, with its filmy beard, it wipes off the slime-covered weeds and stones which abound in oyster beds."

The writer of this screed, posing as a bacteriologist and zoologist, seems to be ignorant alike of both sciences. We can here get an idea of the amount of harm which can be done by *soi disant* teachers through the medium of alleged scientific journals.

It is in the first place evident that this writer is ignorant of zoology. He does not know how the oyster feeds; he thinks it wipes its food off the weeds with its beard! I have seen some individuals use their beards for dinner napkins, but the oyster's is truly useful; it is fork and spoon, too, it appears! Every student of natural history should know that the oyster's beard or ctenidia is his gills; that he feeds by drawing a current of water by ciliary action mainly of the ctenidia into his mouth and lives on the solid particles which are contained in the water, and that the so-called liver is a digestive gland.

Furthermore, the oyster is plainly not designed by nature for a scavenger. His natural habitat is on a clean rocky bottom, and not in the mouth of a river, as fresh water is injurious to him, consequently he cannot live on slime and ooze. When oysters are 'parked' into a muddy or even a sandy bed they do not thrive at all.

After this display of biological ignorance one wonders if the writer, presumably a doctor, can tell a mollusc from a worm.

Now, as to the bacteriology of the matter, it is plain that if the oyster feeds on typhoid bacilli he must assimilate them, and when living things are digested they generally die during the process, consequently when we eat an oyster we do not eat live bacilli. But they can live in the stomach and gut a long time, also other enteric parasites.

It is an unquestionable fact that typhoid fever could not be caused by the introduction of any number, even millions, of dead bacilli into the human body, but, at the most, some temporary illness from the ptomaines in the mixture.

Finally, the 'Medical Progress and so forth' assumes that the oyster's large liver, which, as stated above, is not homologous to the liver, is a poison trap. I was not aware that this was the main function of an hepatic cell. Plainly, the primary deduction from a large liver would be that metabolic processes were complex and that nutriment needed to be stored in large quantity. The oyster's liver, however, does not seem much different from those of his congeners.

All this sensational essay of ignorance will doubtless be reproduced by the small-fry medical journals and the daily press. It must contribute toward hurting the oyster industry. It

must result in many invalids being deprived of a luscious and digestible food, and last, but not least, help to belittle science by reasoning which the common sense of centuries shows to be absurd.

Contrast all this with the calm attitude of the scientific *British Medical Journal*, which contents itself, according to the quotation from it, with calling for scientific investigation of the reason for some beds being polluted.* It seems quite likely that isolated oyster beds might be contaminated with bacilli, but the natural history of the oyster shows that he could not exist under such conditions, and that the bed would die out. In fact, the danger will apparently regulate itself.

I hope that these remarks will draw the attention of practical biologists, competent to set the question at rest; at the same time they will serve to show the great need of at least an elementary knowledge of science among our doctors before they presume to settle questions of the food supply of mankind; and they will serve to show the great lack of that knowledge among the rank and file of practitioners, who, at any rate, 'out west,' appear rather to glory in it.

GEORGE CHAS. BUCHANAN.

CEREBRAL LIGHT.

IN darkness or with closed eyes we can always see irregular forms of light in our visual field. These forms are of various kinds, series of waves, successive rings that spread and break, etc. In addition to these definite figures there is always more or less definite irregular illumination over the whole field. These phenomena are generally called the 'retinal light' or the '*Eigenlicht* of the retina.' They are usually supposed to arise from chemical changes going on in the retina. I wish to record some observations that apparently prove them to be cerebral and not retinal processes.

1. With closed eyes there is only one illuminated field, not two, as there should be from the two retinas if the light were retinal. Two retinal figures might appear as one under the conditions: (*a*) Of suppression of one field, which is not the case here, because it is impossible to keep one field suppressed for many minutes, whereas I have watched the retinal figures in uninterrupted continuance for a long time; (*b*) of perfect identity of form, which is hardly a possible supposition in the case of these irregular, volatile, chemical phenomena; (*c*) of sufficiently similar construction for union by stereoscopic vision, which also is not the case, as there is no relief effect in the picture.

2. The figures do not change in position when the eye is moved. They are localized in front and remain in the same place, even if the eyes are directed to one side. I find, however, that if the eyes are turned to a new position and kept there, the central figure (a spreading violet circle with a phosphorescent rim) will soon afterwards follow the movement; there is thus a tendency for this figure to occupy the spot of sharpest vision.

3. The figures do not change in location when the eyes are displaced. When the eyes are looking at some definite object, *e. g.*, this page, a pressure of the finger on one of them will cause the page apparently to move. This is true whether the other eye is open or closed. Likewise, if an after-image is obtained, it will move upon pressure of the eyeball. The pressure displaces the eyeball and changes the projection of the retinal picture. This displacement does not occur with 'retinal light.' I have repeatedly observed these figures and have manipulated the eyeballs; I have found that they are not in the slightest degree affected by the manipulations. In order to avoid all possibility of errors of observation, I have made the experiments in a series alternately with eyes open and eyes closed. With the eyes open I observed a dimly illuminated window; with them closed I saw the 'retinal' figures. The former always followed the displacements, the latter never.

These observations are, I believe, sufficient to establish the proposition (which I have not seen elsewhere) that the phenomena of vision usually known as 'retinal light' and 'retinal figures' are not originated in the retina, but in the brain. They should therefore be termed 'cerebral light' and 'cerebral figures.'

The following hypothesis seems also justified:

* *Cf.* The investigations by Professor Conn, of Wesleyan University, and of Professor Herdman, of Liverpool College.

The cerebral light is located in those higher centers of the brain which are connected with visual memories and imaginations. While watching the cerebral figures I find that my visual memories or phantastic figures appear in the midst of the cerebral light and frequently cannot be distinguished from them. The close connection of these cerebral figures with the contents of dreams has been repeatedly noticed by Johannes Müller and a series of later observers. There is also the possibility that the hallucinatory visions produced by hashish, mescal and other drugs may be simply modifications of this cerebral light.

E. W. SCRIPTURE.

YALE UNIVERSITY, May 21, 1897.

SCIENTIFIC LITERATURE.

Grundriss der Entwickelungsgeschichte des Menschen und der Säugethiere von DR. MED. OSCAR SCHULTZE. Bearbeitet unter Zugrundelegung der 2. Auflage des Grundrisses der Entwickelungsgeschichte von A. Kölliker. Leipzig, Engelmann. 1897. 8vo. Pp. vii + 468.

Kölliker's well known manual has been so thoroughly reworked by Professor Schultze that it is essentially a new work. In Kölliker's volume the embryology of the chick furnished many of the descriptions and illustrations. Schultze has omitted the chick altogether, confining himself strictly to mammalian development, and has added a comprehensive though very condensed account of the fœtal membranes and placenta in the chief groups of mammals. Many new and admirable figures have been added, of which a considerable majority are original and taken from the author's own preparations.

It is exceedingly difficult to characterize Professor Schultze's text-book fairly, for it combines superior merits with conspicuous and singular defects. It is utterly inadequate as a presentation of contemporary embryology, for it systematically neglects the morphological, phylogenetic and mechanical aspects of embryology, and consequently reads almost like an old-fashioned descriptive anatomy. An embryological writer might be excused for avoiding phylogenetic and mechanical themes, but the neglect of morphological considerations makes full success in writing a text-book an impossibility. To illustrate these criticisms it suffices to examine the account of the nervous system; in the development of this the history of the neuro blasts and of the division of the medullary tube into dorsal and ventral zones are the fundamental facts morphologically, but our author barely describes the neuroblasts, does not figure them at all, and makes no allusion to the two zones, which should form the basis of the whole account, for without understanding these zones no student can master even the rudiments of our present knowledge of the brain and spinal cord. Again, the epidermis is equally maltreated, for the history of the epitrichium is incorrect, and no mention whatever is made of the fact that the nails are modifications of the stratum lucidum. Erroneous are also the accounts of the development of the glands in the stomach, which do *not* develop in the same way as those of the intestine; misleading is the history given of the supra-renals, for the so-called medulla of the organ in the human species is not derived from the sympathetic *Anlage*. There are mistakes in the illustrations: in Figs. 194 and 195 the 'Zwischenhirn' (Diencephalon) is correctly designated, but in Figs. 217 and 263 the same division of the brain is called 'Mittelhirn' (Mesencephalon); in Fig. 327 the left side of the heart is called '*rechte* Kammer' and the right side '*linke* Kammer,' while the great vein is labeled 'Sympathicus!' Of the index complaint must be made: one searches it in vain for Hirnblasen, Nerven, Thyroidea and other headings.

In spite of these criticisms, which indicate that the usefulness of the book is severely limited, the manual remains one of many merits and of great value. The author is felicitous in his combination of brevity and clearness, and in avoiding cumbrous accumulations of details. The faulty illustrations are exceptions; very good ones indeed are the rule, good both in selection and execution. In printing them the publishers have sustained their high reputation in this regard. The author has studied at first hand, and is thereby enabled to make his descriptions fresh, vivid and interesting, and if he had included in his point of view

the recognition of relative morphological values he would have prepared a work of signal utility. The student who uses the 'Grundriss' as his guide may acquire a fair knowledge of the empirical facts of embryology, but he will still have to learn the morphological interpretation of these facts and their relative importance. Meanwhile he will have profited by better, more available and more matter-of-fact descriptions of the anatomy of embryos than can be found in perhaps any other of the smaller text-books of embryology.

C. S. MINOT.

Das Süsswasserplankton, Methode und Resultate der quantitativen Untersuchung. Von DR. CARL APSTEIN, Kiel, Zool. Institut. Mit 113 Abbildungen. Kiel und Leipzig, Verlag von Lipsius & Tischer. 1896. 200 pp., 5 Tabellen.

To Dr. Apstein, of the school of planktologists at Kiel, is to be given the credit of applying the methods employed by Professor Hensen in his investigations in the Baltic and North seas, and on the '*National*' Expedition of 1889, to the quantitative investigation of the plankton of fresh water. His field of operations has been the lake region of Holstein. The book contains a full report of the results of the quantitative, and to some extent the qualitative, examination of more than 300 collections made in 15 different lakes during 1890–1895. A description is given of the apparatus, methods of collection, of determination of volume, and of enumeration of the constituent organisms or planktonts, if we adopt the term recently introduced by Schröter. There is, unfortunately, no adequate discussion of the margin of error which the methods involve. An annotated list of the important limnetic organisms is given with data on the seasonal distribution, abundance with dates of maximum and minimum occurrence and reproductive activity, with other facts of œcological import. Many of the forms are illustrated by reproductions from original microphotographs by the author. The microscope in the hands of the skillful operator reveals vastly more than the ordinary microphotograph records. For the purposes of scientific illustration of organisms of the plankton, and especially in such a book as this, it seems undesirable to substitute a method which rests upon the relative opacity of tissues simply, for one based upon the clear interpretation of the trained observer. One has only to contrast Dr. Apstein's best results in this line with the figures he reproduces from Hudson and Gosse, and Lauterborn, to appreciate the superiority of a carefully made drawing in conveying to the inquirer details of structure, and even such features as contour, proportion and natural position of parts. The book is not a manual of the limnetic fauna and flora, and the novice and casual student must still depend upon monographs and the widely scattered literature of the subject for aid in the determination of the planktonts. It is, however, an epitome of the subject, indispensable to every planktologist and a valuable aid to every student of fresh-water fauna.

Our author distinguishes active, passive and tycho-limnetic forms among the planktonts. With the latter he places *Difflugia*, whose presence in the open water is attributed to gas vacuoles, which cause it to rise from the bottom, its true habitat. *Difflugia* is a very abundant and important member of the plankton of our own great lakes, where it occurs in association with *Codonella*, *Dinobryon* and other typically limnetic forms. It also occurs in the Illinois river and its adjacent waters throughout a considerable part of the year, but in the open water and not upon the bottom. The conditions of the occurrence are such as to place it among the active members of the plankton rather than among those which owe their presence to the accidents of wind and current.

Following up the line of his earlier work, Apstein brings forward a long series of observations in proof of the equal horizontal distribution of the plankton in a body of water. In 80 catches the greatest departure from the mean was 22.8%, and the average departure but 5.52%. These hauls are distributed in short series of 2–5 parallel catches in various lakes, but the distance separating the successive collections is not given, and in no case has a lake been subjected to a larger number of examinations made upon the same day at frequent and regular distances throughout its whole extent. It seems

not improbable that such an examination would enlarge somewhat the variation in distribution as above given. Indeed, in another connection Apstein cites four catches made in Dobersdorfer See upon the same day, in which the variation from the mean is 100% or more, in three instances out of the four. This wide variation is, however, explained by our author as due to the presence of intervening sand bars in the lake. The results of counting individuals of various species in the plankton taken on the same day at different localities show a uniformity less marked than that indicated by the volumetric determination. There is no indicacation whatever of the presence in the plankton of 'swarms,' which Apstein defines as a local accumulation of animals of one species in one locality while the surrounding area is slightly, or not at all, peopled by it. This uniformity in the horizontal distribution is due to the similarity of the chemical constituents in the water, resulting in a uniform growth of the phytoplankton and the zooplankton depending upon it. It is thus primarily a matter of food relations.

The vertical distribution of the plankton was determined by the subtraction process, and is subject to the error produced by the progressive clogging of the net. It seems very desirable that this problem be attacked by the pumping method. Apstein's results indicate the accumulation of the greater part of the plankton in the surface stratum of 0–2 meters, in which from 1½ to 60 times as much plankton is found (per cubic meter) as is present in a similar volume in the water below a depth of 2 meters. In this particular his results are in harmony with those of Reighard, Ward, and Birge upon our own lakes. Most organisms prefer the surface waters, only a few rotifers and *Entomostraca* actively seeking the deeper and colder strata. The vertical distribution of many forms, especially among the phyto-plankton, is closely linked with the life cycle. The maximum numbers occur in surface waters, and as these decrease and resting stages appear, they seek the deeper water, to increase again and rise to the surface as the maximum returns.

Apstein still maintains that plankton-rich and plankton-poor waters are characterized by the predominance of the *Chroöcocaceæ* and *Dinobryon* respectively. Reighard has shown that these criteria cannot be adopted for Lake St. Clair, and later work is making it still more evident that waters may be rich or poor in plankton quite irrespective of the conditions attending such diversity in the lakes of Holstein. The suggestion that plankton-rich waters are occasioned by the abundance of water-fowl is of questionable value, though local data may seem to support it.

Only those familiar with the routine of plankton investigation can appreciate the vast amount of work which Apstein's book represents, though his results will command the attention of everyone interested in the œcological side of biology. The science of fresh-water planktology is still in its infancy; its methods are as yet imperfect, and its problems are so intricate that years of continuous investigation in a number of localities will be required to establish broad generalizations. Dr. Apstein has been a pioneer in the field, and the great value of his work lies in its exploratory character and in his suggestive mapping out of the problems of planktology.

C. A. KOFOID.

UNIVERSITY OF ILLINOIS.

GEOLOGIC ATLAS OF THE UNITED STATES. FOLIO 25, LOUDON, TENNESSEE, 1896.

THE Loudon folio, recently published by the U. S. Geological Survey, represents that portion of the Appalachian province which is situated between the parallels 35° 30′ and 36° and the meridians 84° and 84° 30′. This area contains 968 square miles, divided between Blount, Monroe, Loudon, Knox, Roane and Morgan counties of Tennessee.

The folio consists of a topographic map, a geologic map, structure sections, stratigraphic sections, a map of the economic resources, and descriptive text. The author is Arthur Keith.

The text begins with a general description of the Appalachian province and points out the relations of this part to the others, with regard to its surface features. The local features of the drainage by the Tennessee river and its tributaries, Emory, Clinch, Tellico and Little Tennessee, follow next in description.

The various forms of the surface are pointed out, such as the Great Valley of Tennessee and the portions of the mountain district and the Cumberland Plateau, by which it is bounded, and the relation between these forms and the underlying rocks is made clear.

Under the heading 'Stratigraphy,' the geologic history of the Appalachian province is presented in outline, and the local rock groups are fully described in regard to composition, thickness, location, varieties and mode of deposition. The formations, thirty-three in number, range in age from Cambrian to Carboniferous, far the greater part being Cambrian and Silurian. The mountain district is chiefly underlain by the Ocoee series, whose age is doubtful. Rocks of Carboniferous and Devonian age occupy two small belts on either side of the Great Valley, and Silurian and Cambrian strata are repeated in narrow belts along the Great Valley. Limestones, shales and interbedded sandstones make up the Silurian and Cambrian strata; sandstones and shales, with coal seams and a limestone near the base, constitute the Carboniferous, and the Ocoee rocks are conglomerate, sandstone, slate and limestone.

The details of the strata are graphically represented in the columnar section. The different manner in which the formations decay is discussed, and the dependence of the residual soils and surface forms on the nature of the underlying rock. Great changes occur in the formations of this region, and the Knox dolomite is the only one which is uniform throughout. The direction of change was exactly reversed between Cambrian and Silurian time.

In the discussion of 'structure,' after a general statement of the broader features of the province, two methods are described in which the strata of this quadrangle were deformed. Of these the extreme Appalachian folding, accompanied by faulting and metamorphism, is by far the most prominent and is about equally developed throughout the quadrangle. Faults, especially, are most strikingly exhibited here. Deformation by vertical uplift also is exhibited, but only in comparison with broad surrounding areas. In this quadrangle the Great Valley is at its narrowest, on account of the extreme shortening in deformation. The structure sections illustrate the sharp folds and frequent faults into which the strata were forced.

Economic products of this region are coal, variegated marble, red hematite, building stone, lime, clays, timber and slate. The outcrops of the formations containing these are illustrated on the economic sheet, together with the locations of the mines and quarries. The iron ore and slate are of minor importance now; the coal district is a part of the great coal basin of Tennessee, on the same formations as the chief mining center of the State; and the marble belts are a part of the principal productive region for that stone. Various conditions affecting the value of these deposits are pointed out, and the associations and availability of the building materials and timbers are discussed.

FOLIO 27, MORRISTOWN, TENNESSEE, 1896.

The Morristown folio, also recently published, by the same author, deals with that portion of the Appalachian province which is situated between the parallels 36° and 36° 30′ and the meridians 83° and 83° 30′. This area contains 963 square miles, divided between the counties of Greene, Cocke, Jefferson, Hamblen, Grainger, Claiborne, Hancock and Hawkins, all in Tennessee.

Included in the folio are topographic, economic and geologic maps, structure and stratigraphic sections and five pages of descriptive text.

After a description of the broader features of the Appalachian province, the local geography is analyzed. The various types of surface features are pointed out and their relations to the underlying rocks are shown. Local facts, such as elevations and the drainage by the tributaries of the Tennessee River, the Nolichucky, French Broad, Holston and Clinch Rivers, are detailed.

Under the heading 'Stratigraphy' the geologic history of the Appalachians is presented in outline. This is followed by a detailed account of the local rock groups in regard to their location, composition, thickness, variations and mode of deposition. The soils and forms of surface produced by each formation are discussed with the formations. Twenty formations are distinguished in this quadrangle,

ranging from Cambrian to Carboniferous, far the greater portion being Cambrian and Silurian. The rocks of Carboniferous and Devonian age are found only in two narrow belts in the ridge district and are represented by only four formations. Over the rest of the area Cambrian and Silurian strata are about equally divided. A great variety of limestones, shales and sandstones compose the Cambrian and Silurian rocks, shales and sandstones the Devonian, while only limestone appears in the Carboniferous. Great changes take place in the Silurian strata, and limestones on the northwest are represented by shales and sandstones at the southeast. The general character of the formations is graphically represented in the columnar sections, one being drawn for each of the two chief geologic districts.

In the discussion of structure, after a general statement of the broader features of Appalachian structure, the two types of deformation shown in this region are described, and instances are pointed out in the structure sections. In the ridge district the most prominent feature is the faulting, which has cut the strata up into long, narrow blocks and produced the characteristic ridge topography. Southeast of Holston River the rocks were deformed by close folds. Deformation by vertical uplift is also existent in this region, but it can be observed only in comparison with other and larger areas. In the structure sections most of the details of the different structures are shown.

Economic products of this region are marble, building stone, lead, zinc, lime, cement, clays and timber. The outcrops of the formations containing these are represented on the economic sheet as far as possible, together with the locations of mines and quarries. The principal industries are the production of zinc and marble; the timbers and water-powers are also of general importance. The various conditions which affect the development of these resources are discussed.

SCIENTIFIC JOURNALS.

AMERICAN CHEMICAL JOURNAL, JULY, 1897.

On the Decomposition of Diazo Compounds: By W. E. CHAMBERLAIN, G. F. WEIDA and W. BROMWELL. The three papers contained in this number of the journal on this general subject give the results obtained in the study of the action of methyl alcohol on certain salts of diazobenzenes and diazotoluenes. Chamberlain, following up the suggestion of Remsen and Dashiell, found that, while under ordinary atmospheric pressure the main reaction between methyl alcohol and paradiazotoluene nitrate consisted in the substitution of the methoxyl for the diazo group, yet when the reaction took place under diminished pressure the hydrogen reaction was more favored. With an increase in the pressure the product remained as under ordinary pressure. When sodium methylate is used, and when an alkaline carbonate is added to the alcohol, only the hydrogen reaction takes place. Beeson found that alkalies and zinc dust would not only cause the formation of benzene, by the decomposition of a salt of diazobenzene, but also of diphenyl. The author of this work was, however, unable to obtain any ditolyl from an analogous decomposition of diazotoluene, probably owing to some different conditions of temperature at which the reactions take place.

Weida has compared the results of the decomposition of the three nitranilines and aminobenzoic acids with methyl alcohol, with the results obtained by Remsen and Graham when ordinary alcohol was used.

In the case of the orthonitrodiazobenzene sulphate the only product was nitrobenzene; but the meta- and para-compounds gave a small amount of nitranisol beside the nitrobenzene. The salts of the diazobenzoic acid did not act as they did when treated with ordinary alcohol, but showed a tendency to give the alkoxy reaction. They all gave as the principal product the ethereal salt of the corresponding methoxy acids.

Bromwell followed the same line of research as Chamberlain, using, however, the ortho-compound where the latter had used the para. He found that the ortho-compound decomposes at a lower temperature and gives the alkoxy reaction as the other does. When orthomethoxytoluene was treated with cold concentrated sulphuric acid a monobasic sulphonic acid containing one acid residue was formed, and when it was oxidized the corresponding benzoic

acid was formed. A number of the salts of the acid were prepared.

On the Action of Potassium Hydroxide on Orthomethoxysulphamine-benzoic Acid: By CHAS. WALKER. When the sulphonic acid described in the last paper was converted into an amide and fused with potassium hydroxide the product was not, as was expected, the corresponding dihydroxy-benzoic acid; but, as the author has shown, orthoxysulphaminebenzoic acid. The change can be represented thus:

$$C_6H_3\begin{cases}COOH\\OCH_3\\SO_2NH_2\end{cases}\cdots\cdots\cdots\cdots\cdots C_6H_3\begin{cases}COOH\\OH\\SO_2NH_2\end{cases}$$

Several salts of the acid were also made and studied.

A Simple and Efficient Boiling-Point Apparatus for Use with Low- and with High-Boiling Solvents: By H. C. JONES. The author has modified the apparatus devised by Hite by making it longer and replacing the inner tube by a platinum cylinder. By these changes he claims to have avoided the errors caused by the cold liquid returned by the condenser coming in contact with the thermometer, and also those due to radiation of heat from the bulb of the thermometer. He also replaces the outer vapor jacket, so generally used, by a cylinder of asbestos. A number of results are given which were obtained with both high and low boiling solvents.

Aluminum Alcoholates: By H. W. HILLYER. As was stated in a paper published some time ago, the authors found that when an anhydrous chloride was added to aluminum in alcohol a rapid deposition of the metal and an evolution of hydrogen took place. Dry hydrochloric acid gas or a solution in alcohol will cause a rapid evolution of gas when added to the aluminum in alcohol, and if the action is once started it will continue for some time even if no more acid is added. When the solution cools a crystalline compound, probably an addition product of the chloride and alcohol, separates out. When stannic chloride and hydrochloric acid gas are used it is very important that the materials should be completely dehydrated, as the presence of a small amount of water will stop the reaction. The results seem to show that it is necessary, in order to get a satisfactory action of aluminum on alcohol, that it should be anhydrous; that it should contain an anhydrous chloride with which it can form an addition-product; and, that the aluminum should be coupled with a more easily reducible metal.

Behavior of Chloral Hydrate with Ammonium Sulphide: By J. LESINSKY and C. GUNDLICH. The authors found that a mixture of chloral hydrate and ammonium sulphide will, after a longer or shorter time, depending upon the temperature, form a dark precipitate. They suggest it as a possible test for the purity of chloral hydrate and propose to study the reaction and the product.

A New and Rapid Method for the Quantitative Separation of Iron, Aluminium, Chromium, Manganese, Zinc, Nickel and Cobalt: By A. R. CUSHMAN. This method, which is more rapid than those generally used, has been found very satisfactory; but no details can be given in a review, as it is already in the most condensed form possible. The following reviews are also given: A Resumé of Progress in the Chemistry of the Carbohydrates during 1896; Traité élémentaire de mècanique chimique fondu sur la thermodynamique, P. Duhem; Elektro-Chemische Uebungsaufgaben, F. Oettel; Theorie und Praxis der Analytischen Electrolyse der Metalle, B. Neumann; Le four électrique, H. Moissan.

J. ELLIOTT GILPIN.

NEW BOOKS.

La structure du protoplasma et les théories sur l'hérédité et les grands problémes de la biologie générale. YVES DELAGE. Paris, C. Reinwald et Cie. 1895. Pp. xvi + 878. 24 fr.

Geological Survey of Canada. Annual Report, Vol. VIII., 1895. GEORGE M. DAWSON. Ottawa, S. E. Dawson. 1897.

A Popular Treatise on the Physiology of Plants. PAUL SORAUER. Translated by F. E. WEISS. London and New York, Longmans, Green & Co. 1895. Pp. x + 256.

Water and Public Health. JAMES H. FUERTES. New York, John Wiley & Sons; London, Chapman & Hull, Ltd. 1897. Pp. v + 75.